



# 2005 Service Manual



## AR/SX230 High Output



**YAMAHA**



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## PREFACE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It is not possible to put an entire mechanic's education into one manual, so it is assumed that persons using this book to perform maintenance and repairs on Yamaha machines have a basic understanding of the mechanical concepts and procedures inherent in machine repair technology. Without such knowledge, attempted repairs or service to this model may render it unfit to use and/or unsafe.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

AR230 High Output / SX230 High Output  
SRT1100A-D / SRT1100-D  
Service Manual - 2005  
First Edition  
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March 2005

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Printed in U.S.A.

*Specifications, features and options are subject to  
change without notice.*  
04-574

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## HOW TO USE THIS MANUAL

### MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy-to-read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.

In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.:

- Bearings  
Pitting/Damage → Replace.

To assist you in finding your way about this manual, the Section Title and Major Heading is given at the head of every page.

An index to contents is provided on the first page of each section.

### THE ILLUSTRATIONS

Some illustrations in this manual may differ from the model you have. This is because a procedure described may relate to several models, though only one may be illustrated. (The name of model described will be mentioned in the description).

### REFERENCES

These have been kept to a minimum, however, when you are referred to another section of the manual, you are told the page number.

### WARNINGS, CAUTIONS AND NOTES

Attention is drawn to the various Warnings, Cautions, and Notes which distinguish important information in this manual in the following ways:



The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

#### **⚠ WARNING**

**Failure to follow WARNING instructions could result in severe injury or death to the machine operator, a bystander, or a person inspecting or repairing the jet boat.**

#### **CAUTION:**

**A CAUTION indicates special precautions that must be taken to avoid damage to the jet boat.**

#### **NOTE:**

A NOTE provides key information to make procedures easier or clearer.

#### **IMPORTANT:**

This part has been subjected to change of specification during production.

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## HOW TO READ DESCRIPTIONS

1. A disassembly/installation job instruction mainly consists of the exploded diagram ①.
2. The numerical figures represented by the number ② indicates the order of the job steps.
3. The symbols represented by the number ③ indicates the contents and notes of the job.

For the meanings of the symbols, refer to the next page(s).

4. The REMOVAL AND INSTALLATION CHART ④ is attached to the exploded diagram and explains the job steps, part names, notes for the jobs, etc.
5. The SERVICE POINTS, other than the exploded diagram, explains in detail the items difficult to explain in the exploded diagram of REMOVAL AND INSTALLATION CHART, the Service Points requiring the detailed description ⑤, etc.

**JET PUMP** **NOZZLE, DUCT AND INTAKE**

**NOZZLE, DUCT AND INTAKE EXPLODED DIAGRAM**

6-3

























**JET PUMP** **NOZZLE, DUCT AND INTAKE**

**REMOVAL AND INSTALLATION CHART**

Step	Procedure/Part name	Qty	Service points
	<b>NOZZLE, DUCT AND INTAKE DISASSEMBLY</b>		Follow the left "Step" for removal
	Jet pump unit		Refer to the "JET PUMP UNIT REMOVAL" section
1	Bolt (with washer)	2	
2	Collar	2	
3	Nozzle deflector assembly	1	
4	Bolt	4	
5	Intake duct	1	
6	Pin	2	
7	Housing	1	
8	Pin	2	
9	Impeller duct assembly	1	
10	Pin	2	
11	Nozzle	1	
12	Bolt (with washer)	1	
13	Spacer	1	
14	Oil seal	2	
15	Bushing	1	
16	Bolt (with washer)	6	
17	Intake screen	1	
	<b>NOZZLE DEFLECTOR DISASSEMBLY</b>		
①	Bolt (with washer)	2	6 × 20 mm
②	Collar	2	
③	Nut	1	M6
④	Plate washer	2	
⑤	Ball joint	1	M6
⑥	Nozzle deflector	1	
⑦	Nut	1	M6
⑧	Plate washer	2	
⑨	Ball joint	1	M8
⑩	Trim ring	1	
			Reverse the removal steps for installation

6-4



① <b>GEN INFO</b> 	② <b>SPEC</b> 
③ <b>INSP ADJ</b> 	④ <b>FUEL</b> 
⑤ <b>POWR</b> 	⑥ <b>JET PUMP</b> 
⑦ <b>ELEC</b> 	⑧ <b>HULL DECK</b> 
⑨ <b>TRBL ANLS</b> 	⑩ 
⑪ 	⑫ 
⑬ 	⑭ 
⑮ 	⑯ 
⑰ 	⑱ 
⑲ 	⑳ 
㉑ 	㉒ 
㉓ 	㉔ 

## SYMBOLS

Symbols ① to ⑨ are designed as thumb-tabs to indicate the content of a chapter:

- ① General Information
- ② Specifications
- ③ Periodic Inspection and Adjustment
- ④ Fuel System
- ⑤ Power Unit
- ⑥ Jet Pump Unit
- ⑦ Electrical System
- ⑧ Hull and Deck
- ⑨ Trouble Analysis

Symbols ⑩ to ⑮ indicate specific data:

- ⑩ Special Tool
- ⑪ Specified Liquid
- ⑫ Specified Engine Speed
- ⑬ Specified Torque
- ⑭ Specified Measurement
- ⑮ Specified Electrical Valve  
[Resistance ( $\Omega$ ), Voltage (V),  
Electric Current (A)]

Symbol ⑯ to ⑰ in an exploded diagram indicate grade of lubricant and location of lubrication point:

- ⑯ Apply Yamaha 2-stroke outboard motor oil
- ⑰ Apply water resistant grease (Yamaha grease A, Yamaha marine grease)
- ⑱ Apply molybdenum disulfide grease

Symbols ⑲ to ㉔ in an exploded diagram indicate grade of sealing or locking agent and location of application point:










- ⑲ Apply Gasket Maker®
- ㉑ Apply Yamabond #4 (Yamaha Bond No. 4)
- ㉒ Apply LOCTITE® No. 271 (Red LOCTITE)
- ㉓ Apply LOCTITE® No. 242 (Blue LOCTITE)
- ㉔ Apply LOCTITE® No. 567 (PST)
- ㉕ Apply Silicone Sealant

### NOTE:

In this manual, the above symbols may not be used in every case.

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<b>GEN INFO</b>		<b>GENERAL INFORMATION</b>	<b>1</b>
<b>SPEC</b>		<b>SPECIFICATIONS</b>	<b>2</b>
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<b>POWR</b>		<b>POWER UNIT</b>	<b>5</b>
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<b>ELEC</b>		<b>ELECTRICAL SYSTEM</b>	<b>7</b>
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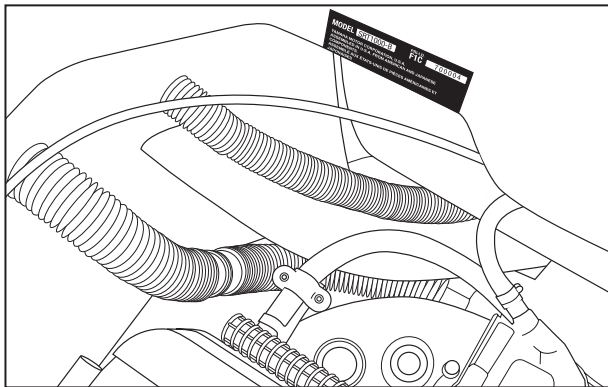
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## CHAPTER 1

### GENERAL INFORMATION

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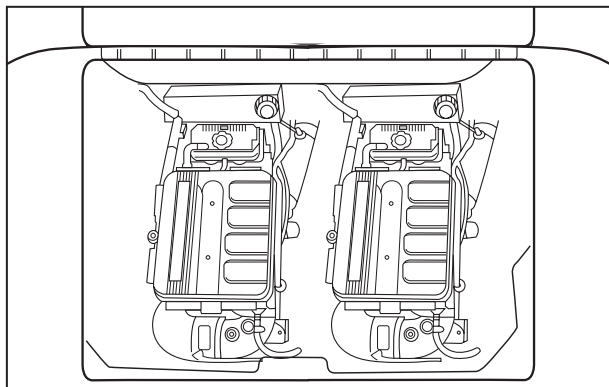
A60700-0\*

**IDENTIFICATION NUMBERS****PRIMARY I.D. NUMBER**

The primary I.D. number is stamped on a label attached to the deck under the rear seat.

**Starting Primary I.D. Number:**

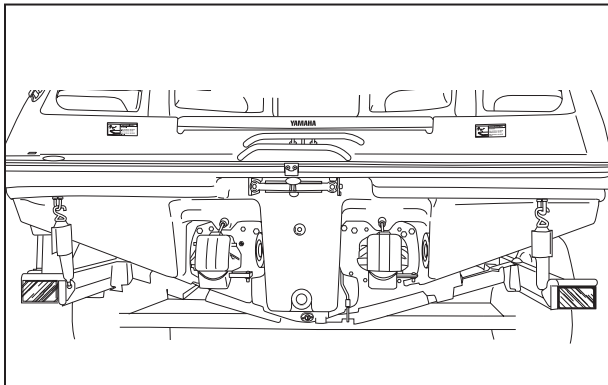
SRT1100-D/SX230HO      F1U-700101  
SRT1100 A-D/AR230HO.      F1U-720101

**ENGINE SERIAL NUMBER**

The engine serial number is stamped on a label attached to the crankcase.

**Starting Engine Serial Number:**

6P6: 1000401

**HULL IDENTIFICATION NUMBER (H.I.N.)**

The H.I.N. is stamped into the hull on the starboard side of the stern.



## SAFETY WHILE WORKING

The procedures given in this manual are those recommended by Yamaha to be followed by Yamaha dealers and their mechanics.

### FIRE PREVENTION

Gasoline (petrol) is highly flammable. Petroleum vapor is explosive if ignited. Do not smoke while handling gasoline (petrol), and keep it away from heat, sparks, and open flames.

### VENTILATION

Petroleum vapor is heavier than air and if inhaled in large quantities will not support life. Engine exhaust gases are harmful to breathe. When test-running an engine indoors, maintain good ventilation.

### SELF-PROTECTION

Protect your eyes with suitable safety spectacles or safety goggles when using compressed air, when grinding or when doing any operation which may cause particles to fly off.

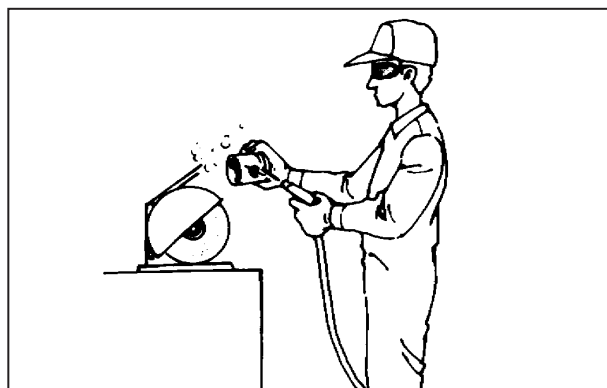
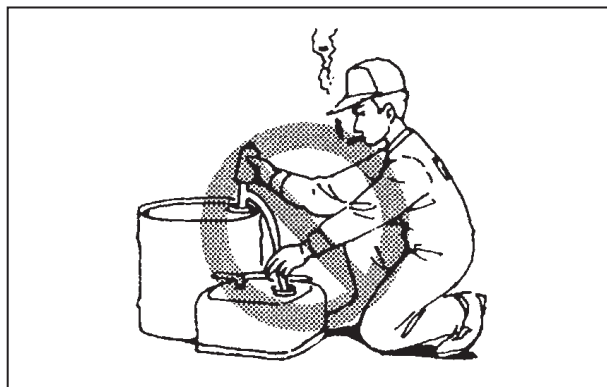
Protect hands and feet by wearing safety gloves and protective shoes if appropriate to the work you are doing.

### OILS, GREASES AND SEALING FLUIDS

Use only Genuine Yamaha oils, greases and sealing fluids or those recommended by Yamaha.

Under normal conditions of use, there should be no hazards from the use of the lubricants mentioned in this manual. However, safety is all-important, and by adopting good safety practices, any risk is minimized. A summary of the most important precautions is as follows:

1. While working, maintain good standards of personal and industrial hygiene.
2. Clothing which has become contaminated with lubricants should be changed as soon as practicable and laundered before further use.



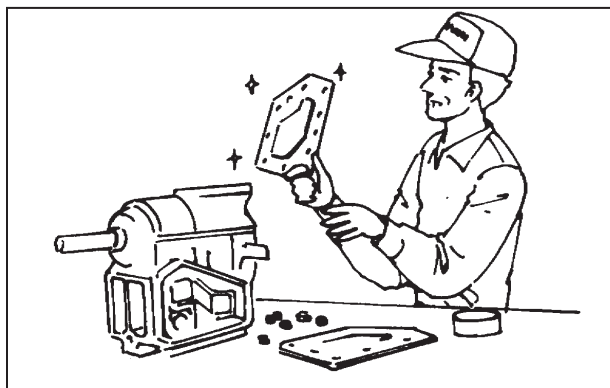


3. Avoid skin contact with lubricants; do not, for example, place a soiled wiping-rag in one's pocket.
4. Hands, and any other part of the body which have been in contact with lubricants or lubricant-contaminated clothing, should be thoroughly washed with hot water and soap as soon as practicable.
5. To protect the skin, the application of a suitable barrier cream to the hands before working is recommended.
6. A supply of clean lint-free cloths should be available for wiping purposes.



### GOOD WORKING PRACTICES

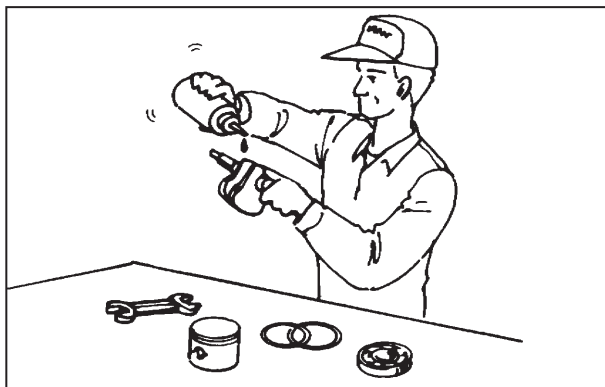
1. The right tools  
Use the special tools that are designed to protect parts from damage. Use the right tool in the right manner – don't improvise.
2. Tightening torque  
Follow the torque tightening instructions. When tightening bolts, nuts and screws, tighten the larger sizes first, and tighten inner-positioned fasteners before outer-positioned ones.
3. Non-reusable items  
Always use new gaskets, packings, o-rings, oil seals, split-pins and circlips, etc. on reassembly.





**DISASSEMBLY AND ASSEMBLY**

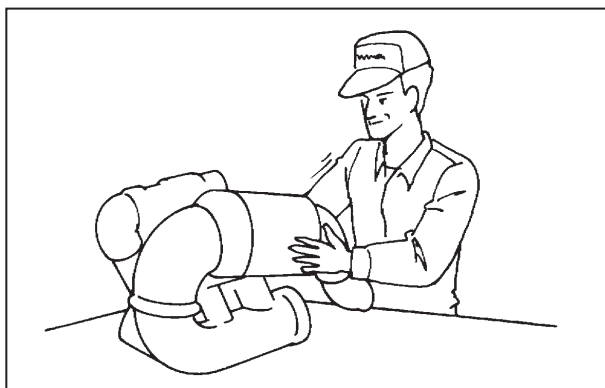
1. Clean parts with solvent and compressed-air on disassembling them.
2. Oil the contact surfaces of moving parts on assembly.



3. After assembly, check that moving parts operate normally.
4. Install bearings with the manufacturer's markings on the side exposed to view and liberally oil the bearings.

**CAUTION:**

**Do not use compressed air to spin the bearings dry. This causes damage to the bearing surfaces.**



5. When installing oil seals, apply a light coating of water-resistant grease to the outside diameter.

**SPECIAL TOOLS**

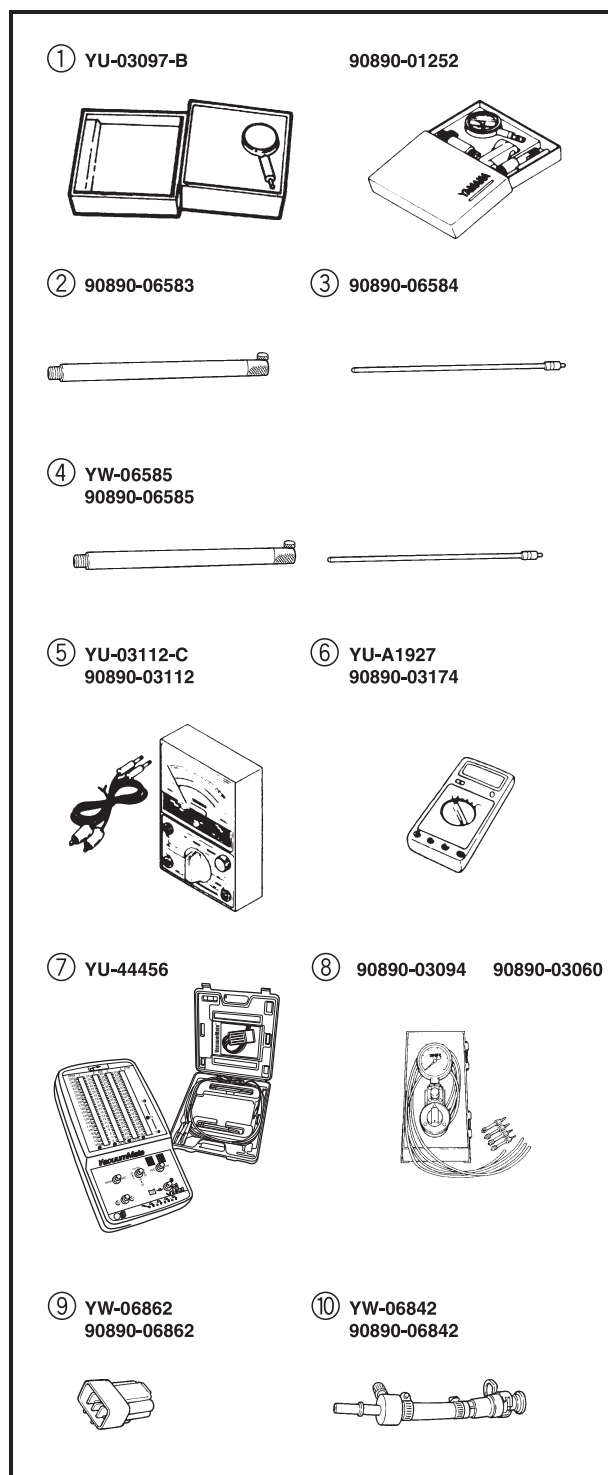
Use of the correct special tools recommended by Yamaha will aid the work and enable accurate assembly and tune-up. Improvisations and use of improper tools can cause damage to the equipment.

**NOTE:**

- For U.S.A. and Canada, use part numbers starting with "J-", "YB-", "YM-", "YS-", "YU-" or "YW-".
- For other countries, use part numbers starting with "90890-".

**MEASURING TOOLS**

- ① Dial Gauge  
P/N YU-03097-B  
90890-01252
- ② Dial Gauge Stand  
P/N 90890-06583
- ③ Dial Gauge Needle  
P/N 90890-06584
- ④ Dial Gauge Stand Set  
P/N YW-06585  
90890-06585
- ⑤ Pocket Tester  
P/N YU-03112-C  
90890-03112
- ⑥ Digital Circuit Tester  
P/N YU-A1927  
90890-03174
- ⑦ Vacuum Synchronizer  
P/N YU-44456
- ⑧ Vacuum Gauge  
P/N 90890-03094  
Vacuum attachment  
P/N 90890-03060
- ⑨ Test Connector  
P/N YW-06862  
90890-06862
- ⑩ Fuel Pressure Gauge Adapter  
P/N YW-06842  
90890-06842

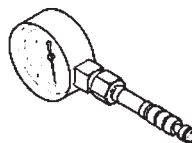




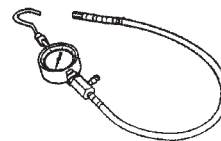
## SPECIAL TOOLS

- ⑪ Fuel Pressure Gauge  
P/N YB-06766  
90890-06786
- ⑫ Compression Gauge Extension  
P/N 90890-06582
- ⑬ Cylinder Gauge Set  
P/N YU-03017  
90890-06759
- ⑭ Compression Gauge  
P/N YU-33223-1  
90890-03160
- ⑮ Peak Voltage Adapter  
P/N YU-39991  
90890-03172
- ⑯ Spark Gap Tester  
P/N YM34487  
90890-06754
- ⑰ Test Harness (2 pins)  
P/N YB-06792  
90890-06792
- ⑱ Test Harness (3 pins)  
P/N YB-06791  
90890-06791
- ⑲ Test Harness (3 pins)  
P/N YB-06770  
90890-06770
- ⑳ Test Harness (6 pins)  
P/N YB-06790  
90890-06790
- ㉑ Test Harness (3 pins)  
P/N YB-06793  
90890-06793
- ㉒ Test Harness ( 3 pins)  
P/N YB-06777  
90890-06777

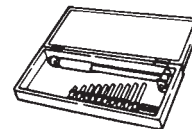
⑪ YB-06766



90890-06786



⑫ 90890-06582

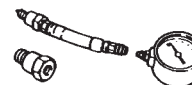
⑬ YU-03017  
90890-06759

- ⑭ Compression Gauge  
P/N YU-33223-1  
90890-03160

⑭ YU-33223-1



90890-03160

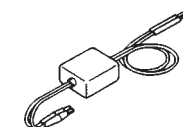


- ⑮ Peak Voltage Adapter  
P/N YU-39991  
90890-03172

⑮ YU-39991

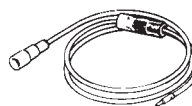


90890-03172

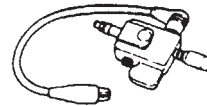


- ⑯ Spark Gap Tester  
P/N YM34487  
90890-06754

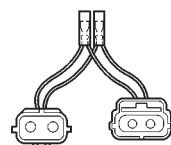
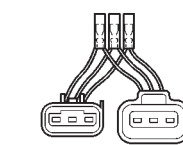
⑯ YM-34487



90890-06754



- ⑰ Test Harness (2 pins)  
P/N YB-06792  
90890-06792

⑰ YB-06792  
90890-06792⑱ YB-06791  
90890-06791

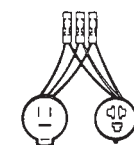
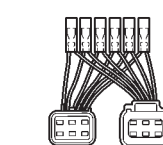
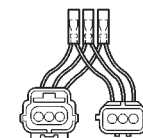
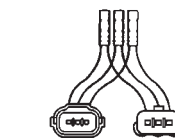
- ⑱ Test Harness (3 pins)  
P/N YB-06791  
90890-06791

- ⑲ Test Harness (3 pins)  
P/N YB-06770  
90890-06770

- ⑳ Test Harness (6 pins)  
P/N YB-06790  
90890-06790

- ㉑ Test Harness (3 pins)  
P/N YB-06793  
90890-06793

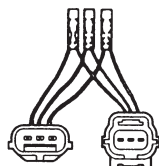
- ㉒ Test Harness ( 3 pins)  
P/N YB-06777  
90890-06777

⑲ YB-06770  
90890-06770⑳ YB-06790  
90890-06790㉑ YB-06793  
90890-06793㉒ YB-06777  
90890-06777





②③ YB-06769  
90890-06769



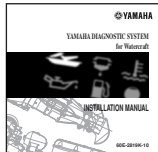
②④ YB-35956-A  
90890-06756



②⑤ LIT-YDIS1-21-00



②⑥ 60V-WS850-00-00 USB Cable /  
68F-WS850-00-00 Serial Cable



## SPECIAL TOOLS

②③ Test Harness (3 pins)  
P/N YB-06769  
90890-06769

②④ Vacuum/Pressure Pump Gauge Set  
P/N YB-35956-A  
90890-06756

②⑤ Yamaha Diagnostic System for Watercraft  
P/N LIT-YDIS1-23-00

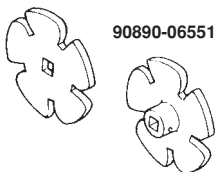
②⑥ Yamaha Diagnostic System Connector  
for Watercraft  
P/N 60V-WS850-00-00 USB Cable  
P/N 68F-WS850-00-00 Serial Cable



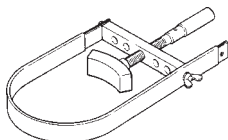
- ① YU-38411  
90890-01426



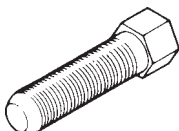
- ② YW-06551



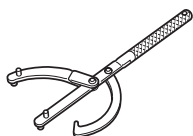
- ③ YS-01880-A  
90890-01701



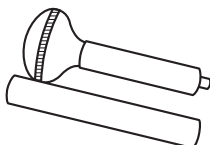
- ④ YM-01082  
90890-01080



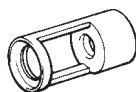
- ⑤ YU-01235  
90890-01235



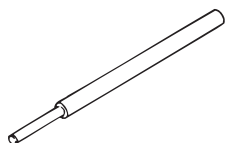
- ⑥ YM-45469  
90890-04019



- ⑦ YM-4114 (∅19 mm)  
90890-04114 (∅19 mm)  
YM-4108 (∅22 mm)  
90890-04108 (∅22 mm)



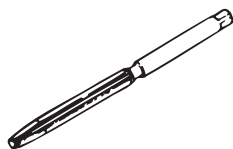
- ⑧ YM-04111 (∅4.0 mm)  
90890-04111 (∅4.0 mm)  
YM-04116 (∅4.5 mm)  
90890-04116 (∅4.5 mm)



- ⑨ YM-04112 (∅4.0 mm)  
90890-04112 (∅4.0 mm)  
YM-04117 (∅4.5 mm)  
90890-04117 (∅4.5 mm)



- ⑩ YM-04113 (∅4.0 mm)  
90890-04113 (∅4.0 mm)  
YM-04118 (∅4.5 mm)  
90890-04118 (∅4.5 mm)



## REMOVAL AND INSTALLATION TOOLS

- ① Oil Filter Wrench  
P/N YU-38411  
90890-01426
- ② Coupler Wrench  
P/N YW-06551  
90890-06551
- ③ Sheave Holder  
P/N YS-01880-A  
90890-01701
- ④ Rotor Puller  
P/N YM-01082  
90890-01080
- ⑤ Rotor Holder  
P/N YU-01235  
90890-01235
- ⑥ Valve Remover/Installer Kit  
P/N YM-45469  
90890-04019
- ⑦ Valve Spring Compressor Attachment  
P/N YM-4114 (∅19 mm)  
90890-04114 (∅19 mm)  
YM-4108 (∅22 mm)  
90890-04108 (∅22 mm)
- ⑧ Valve Guide Remover  
P/N YM-04111 (∅4.0 mm)  
90890-04111 (∅4.0 mm)  
YM-04116 (∅4.5 mm)  
90890-04116 (∅4.5 mm)
- ⑨ Valve Guide Installer  
P/N YM-04112 (∅4.0 mm)  
90890-04112 (∅4.0 mm)  
YM-04117 (∅4.5 mm)  
90890-04117 (∅4.5 mm)
- ⑩ Valve Guide Reamer  
P/N YM-04113 (∅4.0 mm)  
90890-04113 (∅4.0 mm)  
YM-04118 (∅4.5 mm)  
90890-04118 (∅4.5 mm)

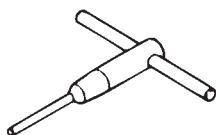


- ⑪ 90890-06813 (60°)  
90890-06814 (45°)  
90890-06815 (30°)

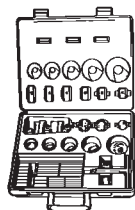


- 90890-06315 (60°)  
90890-06312 (45°)  
90890-06328 (30°)

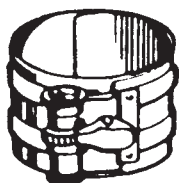
- ⑫ 90890-06811 (ø4.0 mm)  
90890-06812 (ø4.5 mm)



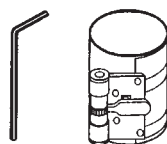
- ⑬ YM-91043-C



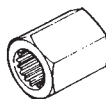
- ⑭ YM-08037



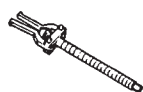
- 90890-05158



- ⑮ YB-06151  
90890-06519



- ⑯ YB-06096



- ⑰ 90890-06501



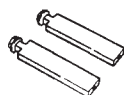
- ⑱ 90890-06535



- ⑲ 90890-06536



- ⑳ 90890-06538



- ㉑ 90890-06652



- ㉒ YB-06112  
YB-06196

- 90890-06614  
90890-06653



- ⑪ Valve Seat Cutter

Intake

P/N 90890-06813 (60°)  
90890-06814 (45°)  
90890-06815 (30°)

Exhaust

P/N 90890-06315 (60°)  
90890-06312 (45°)  
90890-06328 (30°)

- ⑫ Valve Seat Cutter Holder

P/N 90890-06811 (ø4.0 mm)  
90890-06812 (ø4.5 mm)

- ⑬ Valve Seat Cutter Set

P/N YM-91043-C

- ⑭ Piston Ring Compressor

P/N YM-08037  
90890-05158

- ⑮ Drive Shaft Holder (Impeller)

P/N YB-06151  
90890-06519

- ⑯ Slide Hammer Set (jet pump bearing)

P/N YB-06096

- ⑰ Stopper Guide Plate (jet pump bearing)

P/N 90890-06501

- ⑱ Bearing Puller (jet pump bearing)

P/N 90890-06535

- ⑲ Bearing Puller Claw 1 (jet pump bearing)

P/N 90890-06536

- ㉑ Stopper Guide Stand (jet pump bearing)

P/N 90890-06538

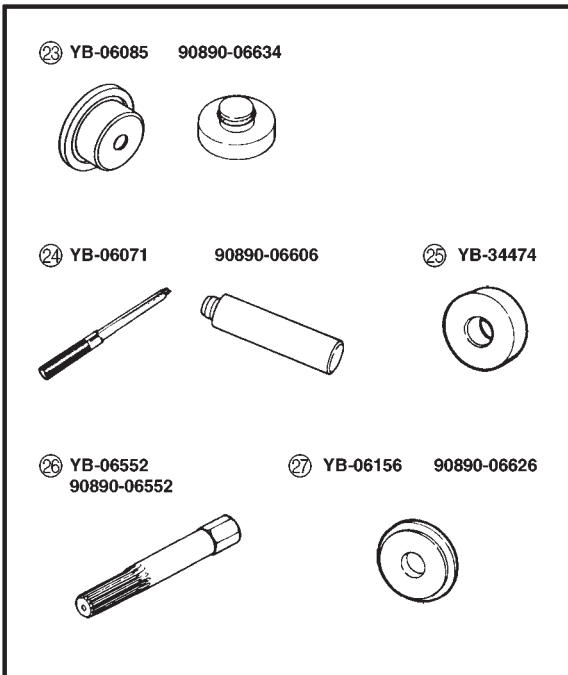
- ㉒ Drive Rod L3 (jet pump bearing)

P/N 90890-06652

- ㉓ Needle Bearing Attachment  
(jet pump bearing and oil seal)

P/N YB-06112, YB-06196  
90890-06614, 90890-06653





- ②③ Ball bearing attachment  
(jet pump oil seal)  
P/N. YB-06085  
90890-06634
- ②④ Driver rod  
(intermediate shaft and jet pump)  
P/N. YB-06071  
90890-06606
- ②⑤ Bearing inner/outer race attachment  
(jet pump bearing)  
P/N. YB-34474
- ②⑥ Shaft holder (intermediate shaft)  
P/N. YB-06552  
90890-06552
- ②⑦ Bearing outer race attachment  
(intermediate shaft)  
P/N. YB-06156  
90890-06626

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## **CHAPTER 2**

### **SPECIFICATIONS**

<b>GENERAL SPECIFICATIONS</b> .....	2-1
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## GENERAL SPECIFICATIONS

Item	Unit	Model
		SRT1100
Model code		
Hull		F1U
Engine/jet		6P6
Dimensions		
Length	m (ft)	7.0 (23.0 ft)
Width	m (ft)	2.6 (8.5 ft)
Height	m (ft)	SX: 2.1 (6.92 ft); AR: 3.1 (10.3 ft)
Dry weight	kg (lb)	SX: 1372 (3025 lb); AR: 1406 (3100 lb)
Maximum capacity	Person/kg (lb)	10 /816 (1800 lb)
Performance		
Maximum output	kW (PS) @ r/min	117.7 (160) @ 10,000
Maximum fuel consumption	l/h (US gal/h, Imp gal/h)	45 (11.9, 9.9)
Cruising range	h	1.56
Engine		
Engine type		4-stroke, L4, DOHC
Displacement	cm <sup>3</sup> (cu. in)	1,052 (64.2)
Bore × stroke	mm (in)	76.0 x 58.0 (2.99 x 2.28)
Compression ratio		11.9:1
Exhaust system		Wet exhaust
Lubrication system		Dry sump
Cooling system		Water cooled
Starting system		Electric starter
Ignition system		TCI
Ignition timing	Degree	BTDC 5-BTDC 32
Spark plug model (manufacturer)		CR9EB (NGK)
Spark plug gap	mm (in)	0.7–0.8 (0.028–0.031)
Battery capacity	V/Ah	12/19
Generator output	A @ r/min	14–16 @ 6,000
Drive unit		
Propulsion system		Jet pump
Jet pump type		Axial flow, single stage
Impeller rotation (from rear)		Counterclockwise
Transmission		Direct drive from engine
Gear ratio		19/28 (0.68)
Jet thrust nozzle horizontal angle	Degree	24 + 24
Jet thrust nozzle trim angle	Degree	+3
Impeller pitch	Degree	Port 18.1° / Stbd. 15.1°
Reverse system		Reverse gate



## GENERAL SPECIFICATIONS

Item	Unit	Model
		SRT1100
Fuel and oil		
Fuel type		Regular unleaded gasoline
Minimum fuel rating	PON*	86
	RON*	90
Fuel tank capacity	L (US gal)	189 (50 gal)
Engine oil type		4-stroke motor oil
Engine oil grade	API	SE, SF, SG, SH, SJ, SL
	SAE	10W-30
Engine oil quantity	L	4.3 (4.5, 3.8)
(without oil filter replacement)	L	2.0 (2.1, 1.8)
(with oil filter replacement)	L	2.2 (2.3, 1.9)
	(US qt, Imp qt)	
	(US qt, Imp qt)	
	(US qt, Imp qt)	

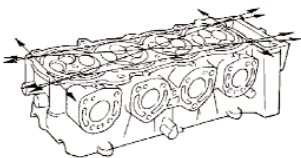
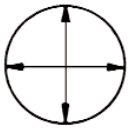

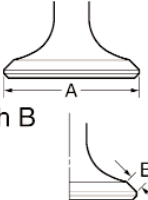
PON\*: Pump Octane Number = (Motor Octane Number + Research Octane Number)/2

RON\*: Research Octane Number



## MAINTENANCE SPECIFICATIONS

### ENGINE

Item	Unit	Model
		SRT1100
Cylinder head Warpage limit 	mm (in)	0.1 (0.004)
Compression pressure*1	kPa (kgf/cm <sup>2</sup> , psi)	1,150 (11.5, 164)
Cylinder Bore size Taper limit Out-of-round limit Wear limit 	mm (in) mm (in) mm (in) mm (in)	76.000–76.015 (2.9921–2.9927) 0.08 (0.003) 0.05 (0.002) 76.100 (2.9961)
Camshaft Drive system Intake A Exhaust A Intake and exhaust B Camshaft cap inside diameter Camshaft journal diameter Camshaft-journal-to-camshaft-cap clearance Maximum camshaft runout 	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	Chain drive 32.55 (1.281) 33.00 (1.299) 25.00 (0.984) 24.5 (0.9646) 24.46–24.47 (0.9630–0.9634) 0.03–0.06 (0.0012–0.0024) 0.03 (0.0012)
Timing chain Model/number of links Tensioning system		DID SCR-0412SV/130 Automatic
Valves, valve seats, valve guides Valve clearance (cold) Intake Exhaust Valve dimensions Valve head diameter A Intake Exhaust Valve face width B Intake Exhaust 	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	0.11–0.20 (0.0043–0.0079) 0.25–0.34 (0.0098–0.0134) 22.9–23.1 (0.9016–0.9094) 24.4–24.6 (0.9606–0.9685) 1.76–2.90 (0.0693–0.1142) 1.76–2.90 (0.0693–0.1142)


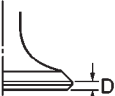
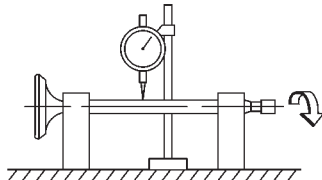
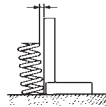

\*1 Measuring conditions:

Ambient temperature 20 °C (68 °F), wide open throttle, with spark plugs removed from all cylinders.

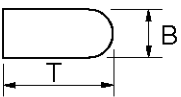
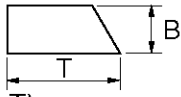
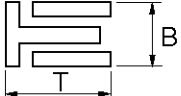
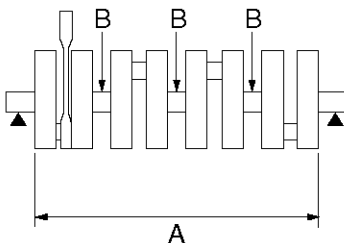
The figures are for reference only.



## MAINTENANCE SPECIFICATIONS

Item	Unit	Model
		SRT1100
Valve seat width C Intake Exhaust 	mm (in) mm (in)	0.9–1.1 (0.0354–0.0433) 0.9–1.1 (0.0354–0.0433)
Valve margin thickness D Intake Exhaust 	mm (in) mm (in)	0.5–0.9 (0.0197–0.0354) 0.5–0.9 (0.0197–0.0354)
Valve stem diameter Intake Exhaust	mm (in) mm (in)	3.975–3.990 (0.1565–0.1571) 4.460–4.475 (0.1756–0.1762)
Valve guide inside diameter Intake Exhaust	mm (in) mm (in)	4.000–4.012 (0.1575–0.1580) 4.500–4.512 (0.1772–0.1776)
Valve-stem-to-valve-guide clearance Intake Exhaust	mm (in) mm (in)	0.010–0.037 (0.0004–0.0015) 0.020–0.047 (0.0008–0.0019)
Valve stem runout 	mm (in)	0.01 (0.0004)
Valve spring Free length Intake Exhaust Installed length Intake Exhaust Spring limit Intake Exhaust 	mm (in) mm (in) mm (in) mm (in) Degree/mm (in) Degree/mm (in)	38.90 (1.53) 40.67 (1.60) 34.50 (1.36) 35.00 (1.38) 2.5/1.7 (0.067) 2.5/1.8 (0.071)
Piston Piston-to-cylinder clearance Piston diameter Measuring point H* Wear limit Piston pin boss inside diameter 	mm (in) mm (in) mm (in) mm (in) mm (in)	0.10–0.11 (0.0039–0.0043) 73.955–73.970 (2.9116–2.9121) 5 (0.2) 0.17 (0.0067) 17.002–17.013 (0.6693–0.6698)
Piston pins Outside diameter Wear limit	mm (in) mm (in)	16.991–17.000 (0.6689–0.6693) 16.971 (0.6681)



Item	Unit	Model
		SRT1100
<b>Piston ring</b> Top ring  Type Dimension (B × T) End gap (installed) Ring groove clearance 2nd ring  Type Dimensions (B × T) End gap (installed) Ring groove clearance Oil ring  Dimensions (B × T) End gap (installed) Ring groove clearance	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	Barrel 0.90 × 2.75 (0.04 × 0.11) 0.32–0.44 (0.0126–0.0173) 0.030–0.065 (0.0012–0.0026) Taper 0.80 × 2.80 (0.03 × 0.11) 0.43–0.58 (0.0169–0.0228) 0.020–0.055 (0.0008–0.0022) 1.50 × 2.60 (0.06 × 0.10) 0.10–0.35 (0.0039–0.0138) 0.040–0.160 (0.0016–0.0063)
<b>Connecting rod</b> Big end oil clearance Bearing color code Small end inside diameter	mm (in) mm (in)	0.016–0.040 (0.0006–0.0016) 1. Brown 2. Black 3. Blue 4. Green 17.005–17.018 (0.6694–0.6699)
<b>Crankshaft</b>  Crank width A Deflection limit B Crankshaft journal oil clearance Bearing color code	mm (in) mm (in) mm (in)	304.8–306.0 (12.00–12.05) 0.03 (0.0012) 0.004–0.028 (0.0002–0.0011) 1. Brown 2. Black 3. Blue 4. Green 5. Yellow
<b>Throttle body</b> Type/quantity Manufacturer ID mark Trolling speed	r/min	42EIS/4 Mikuni 6P601 1,550–1,750
<b>Fuel pump</b> Pump type Fuel pressure	kPa (kgf/cm <sup>2</sup> , psi)	Electrical 310–330 (3.1–3.3, 45–47)



## MAINTENANCE SPECIFICATIONS

Item	Unit	Model
		SRT1100
Oil filter		
Oil filter type		Cartridge type
Oil pump		
Oil pump type		Trochoid
Rotor tip clearance	mm (in)	0.09–0.15 (0.004–0.006)
Oil pump housing clearance		
Rotor (feed pump)	mm (in)	0.09–0.17 (0.0035–0.0067)
Rotor (scavenge pump)	mm (in)	0.09–0.19 (0.0035–0.0075)

## JET PUMP UNIT

Item	Unit	Model
		SRT1100
Jet pump		
Impeller material		Stainless steel
Number of impeller blades		3
Impeller pitch angle	Degree	Port 18.1 Stbd. 15.1
Impeller clearance	mm (in)	0.35–0.45 (0.01384–0.0177)
Impeller clearance limit	mm (in)	0.6 (0.0236)
Drive shaft runout limit	mm (in)	0.3 (0.0118)
Nozzle diameter	mm (in)	86.5–87.1 (3.41–3.43)

## ELECTRICAL

Item	Unit	Model
		SRT1100
Battery		
Type		Marine Group 24
Capacity	V/Ah	Dual Purpose 675 CCA
Specific gravity		100 (12/68.4)
ECM unit		
(B/R – Ground for cylinder #1 and #4)		
(B/W – Ground for cylinder #2 and #3)		
Output peak voltage lower limit		
@ cranking	V	7
@ 2,000 r/min	V	258
@ 3,500 r/min	V	258



## MAINTENANCE SPECIFICATIONS

### ELECTRICAL

Item	Unit	Model
		SRT1100
ECM unit (B/R – R/Y, B/W – R/Y, B/Y – R/Y, B/L – R/Y)		
Output peak voltage lower limit		
@cranking (loaded)	V	87
@2,000 r/min (loaded)	V	86
@3,500 r/min (loaded)	V	85
Stator		
Pickup coil (W – B, R – B)		
Output peak voltage		
@cranking (unloaded)	V	5.2
@cranking (loaded)	V	4.7
@2,000 r/min (loaded)	V	26.1
@3,500 r/min (loaded)	V	41.3
Lighting coil (G – G)		
Output peak voltage		
@cranking (unloaded)	V	9.2
@2,000 r/min (unloaded)	V	38.5
@3,500 r/min (unloaded)	V	63.2
Pickup coil resistance (W – B)	Ω (color)	459–561
Pickup coil resistance (R – B)	Ω (color)	459–561
Lighting coil resistance (G – G)	Ω (color)	0.54–0.66
Minimum charging current	A @ r/min	14 @ 6,000
Ignition coil		
Primary coil resistance	Ω	1.19–1.61
Secondary coil resistance	kΩ	8.5–11.5
Rectifier/regulator (R – B)		
Output peak voltage		
@3,500 r/min (unloaded)	V	15.0
Starter motor		
Type		Constant mesh
Output	kW	0.8
Rating	Seconds	30
Brush length	mm (in)	12.5 (0.49)
Wear limit	mm (in)	6.5 (0.26)
Commutator undercut	mm (in)	0.7 (0.03)
Limit	mm (in)	0.2 (0.01)
Commutator diameter	mm (in)	28.0 (1.10)
Limit	mm (in)	27.0 (1.06)













## MAINTENANCE SPECIFICATIONS

Item	Unit	Model
		SRT1100
Starter relay		
Rating	Seconds	30
Thermoswitch		
ON temperature (engine)	°C (°F)	84–90 (183–194)
OFF temperature (engine)	°C (°F)	70–84 (158–183)
ON temperature (exhaust)	°C (°F)	94–100 (201–212)
OFF temperature (exhaust)	°C (°F)	80–94 (176–201)
Engine temperature sensor		
Engine temperature sensor resistance (B/Y – B/Y)		
@ 20 °C (68 °F)	kΩ	54.2–69.0
@ 100 °C (212 °F)	kΩ	3.12–3.48
Speed sensor		
Output voltage (on pulse)	V	11.6
Output pulse/one full turn		2
Throttle position sensor		
Output voltage (P – B/O)		
@ trolling speed	V	0.756 ± 0.016
Cam position sensor		
Output voltage (G/O – B/O)		
Position A	V	More than 4.8
Position B	V	Less than 0.8
Position C	V	More than 4.8
Fuel sender		
Fuel sender resistance		
Position A	Ω	133.5–136.5
Position B	Ω	5–7
Oil pressure switch		
Oil pressure switch continuity pressure	kPa (kgf/cm <sup>2</sup> , psi)	128 (1.28, 18.2)–166 (1.66, 23.6)
Fuel injector		
Fuel injector resistance <sup>*1</sup>	Ω	11.5–12.5
Fuse		
Rating		
Main	V/A	12/20
Remote control unit	V/A	12/3
Electrical bilge pump	V/A	12/3

\*1 The figures are for reference only.




















## TIGHTENING TORQUES SPECIFIED TORQUES

Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					N•m	kgf•m	ft•lb	
Fuel system								
Retainer/fuel pump module – fuel tank	1st	Screw	1/4-20	16	4.9	0.49	3.5	
	2nd				7.9	0.79	5.6	
Fuel filler neck/rubber seal – deck		Nut	8-32	6	2.3	0.23	1.6	
Fuel sender			10-24	5	2.9	0.29	2.1	 572
Air filter case cover – air filter case		Screw	M5	2	2.5	0.25	1.8	 572
Ribbon sub assembly – throttle bodies		Bolt	M6	4	6.5	0.65	4.7	 242
Throttle cable holder – air filter case		Bolt	M6	2	7.6	0.76	5.5	 572
Fuel hose holder – fuel hose bracket		Bolt	M4	2	3.3	0.33	2.4	 572
Throttle bodies – throttle body joint		Bolt	M8	8	22	2.2	16	 E
Air filter case – air filter case stay 1/ air filter case stay 2	1st	Bolt	M8	3	8.8	0.88	6.4	 242
	2nd				18	1.8	13	
Wire harness bracket 1/sub wire harness – air filter case		Bolt	M6	2	7.6	0.76	5.5	 572
Fuel hose bracket/wire harness bracket 2 – air filter case		Bolt	M6	2	7.6	0.76	5.5	 242
Wire harness bracket 2 – air filter case		Screw	M5	1	1.3	0.13	0.9	 572
Air filter case stay 1 – exhaust pipe 3	1st	Bolt	M8	2	15	1.5	11	 271
	2nd				39	3.9	28	
Air filter case stay 2 – cylinder head	1st	Bolt	M8	1	15	1.5	11	 271
	2nd				39	3.9	28	
Band – air filter case		Screw	M5	1	1.3	0.13	0.9	
Breather cover – air filter case		Screw	M5	3	1.8	0.18	1.3	
Fuel rail – throttle bodies		Bolt	M6	4	5.0	0.5	3.6	
Sensor assembly – fuel rail		Screw	M5	2	3.5	0.35	2.5	
Bracket – throttle bodies		Screw	M6	3	5.0	0.5	3.6	
Bracket – bypass valve motor		Nut	—	2	13	1.3	9.4	
Throttle stop guide – throttle bodies		Screw	M6	2	5.0	0.5	3.6	
Throttle stop screw bracket – throttle bodies		Screw	M6	2	5.0	0.5	3.6	
Throttle position sensor – throttle bodies		Screw	M4	2	2.0	0.2	1.4	



















## TIGHTENING TORQUES

Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					N•m	kgf•m	ft•lb	
Engine								
Engine unit – engine mount		Bolt	M8	4	17	1.7	12	
Oil filter		—	—	1	17	1.7	12	
Coupling cover – intermediate housing		Bolt	M6	1	7.8	0.78	5.6	
Thermoswitch (exhaust) – exhaust pipe 3		Bolt	M6	2	7.6	0.76	5.5	
Outer exhaust joint clamp – exhaust pipe 3/exhaust pipe 2	1st	—	—	2	4.4	0.44	3.2	
	2nd				4.4	0.44	3.2	
Inner exhaust joint clamp – exhaust pipe 3/exhaust pipe 2	1st	—	—	2	4.4	0.44	3.2	
	2nd				4.4	0.44	3.2	
Exhaust pipe 3 – crankcase <sup>*1</sup>	1st	Bolt	M10	4	2.0	0.2	1.4	
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Exhaust pipe end – exhaust pipe 3	1st	Bolt	M6	3	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Exhaust pipe stay – crankcase	1st	Bolt	M8	2	15	1.5	11	
	2nd				42	4.2	30	
Exhaust pipe 1 – exhaust pipe stay	1st	Bolt	M10	1	15	1.5	11	
	2nd				42	4.2	30	
Exhaust pipe 2 – exhaust pipe 1 <sup>*1</sup>	1st	Nut	—	5	39	3.9	28	
	2nd				39	3.9	28	
Exhaust pipe 1 – exhaust manifold 1/ exhaust manifold 2	1st	Bolt	M8	10	22	2.2	16	
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Exhaust manifold 1 – cylinder head	1st	Bolt	M8	6	22	2.2	16	
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Exhaust manifold 2 – cylinder head	1st	Bolt	M8	5	22	2.2	16	
	2nd				22	2.2	16	
	3rd				35	3.5	25	
Water jacket – oil tank	1st	Bolt	M6	4	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil tank stay/reduction drive gear case – oil separator	1st	Bolt	M6	3	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Cover (ground lead) – oil tank		Bolt	M6	3	7.6	0.76	5.5	
Ground lead – oil tank		Bolt	M6	2	7.6	0.76	5.5	
Oil tank – reduction drive gear case	1st	Bolt	M8	5	15	1.5	11	
	2nd				39	3.9	28	

\*1 For details, refer to the tightening procedures in this manual.























**TIGHTENING TORQUES**

Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks
					N•m	kgf•m	ft•lb	
Oil tank – oil tank stay	1st	Nut	—	2	2.0	0.2	1.4	
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Oil tank stay – cylinder head	1st	Bolt	M10	2	2.0	0.2	1.4	
	2nd				15	1.5	11	
	3rd				39	3.9	28	
Band/collar – oil tank		Bolt	M6	1	7.6	0.76	5.5	
Bracket (coupling cover) – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Hanger – oil tank cover	1st	Bolt	M6	4	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil tank cover – oil tank	1st	Bolt	M6	8	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil breather plate 1/ oil breather plate 2 – oil tank cover	1st	Bolt	M5	10	1.9	0.19	1.4	
	2nd				4.4	0.44	3.2	
Baffle plate – oil tank	1st	Bolt	M5	3	1.9	0.19	1.4	
	2nd				4.4	0.44	3.2	
Oil strainer – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil cooler cover – oil tank	1st	Bolt	M6	24	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Anode – oil tank		Screw	M4	1	3.7	0.37	2.7	
Oil pump assembly – reduction drive gear case	1st	Bolt	M6	5	10	1.0	7.2	
			M8	4	15	1.5	11	
	2nd				28	2.8	20	
Drain plug (engine oil)		Bolt	M8	1	20	2.0	14	
Strainer – reduction drive gear case	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
Oil pump housing cover 1 – oil seal housing 1		Bolt	M8	1	20	2.0	14	
Oil pump housing cover 1/oil seal housing 1/oil pump housing cover 2 – oil pump housing 2		Bolt	M8	3	20	2.0	14	
Oil pump housing cover 2 – oil seal housing 1		Screw	M4	1	2.0	0.2	1.4	
Drive coupling – drive shaft		—	—	1	28	2.8	20	
Reduction drive gear case – crankcase	1st	Bolt	M6	2	3.7	0.37	2.7	
	2nd				7.6	0.76	5.5	
	1st	Bolt	M8	5	15	1.5	11	
	2nd				28	2.8	20	
Starter motor lead – starter motor		Nut	—	1	4.9	0.49	3.5	
Starter motor – crankcase		Bolt	M8	2	18	1.8	13	



















### TIGHTENING TORQUES

Part to tightened		Part name	Thread size	Q'ty	Tightening torque			Remarks	
					N•m	kgf•m	ft•lb		
Generator cover – crankcase	1st	Nut	—	2	15	1.5	11		
	2nd				50	5.0	36		
	1st	Bolt	M10	8	15	1.5	11		
	2nd				50	5.0	36		
Rotor – crankshaft		Bolt	M10	1	75	7.5	54		
Rotor – starter clutch		Bolt	M8	6	24	2.4	17		
Washer/pickup coil lead and lighting coil lead – generator cover		Bolt	M5	3	4.9	0.49	3.5		
Pickup coil – generator cover		Bolt	M5	4	4.9	0.49	3.5		
Holder (wire harness) – generator cover		Bolt	M6	2	14	1.4	10		
Lighting coil – generator cover		Bolt	M6	3	14	1.4	10		
Spark plug		—	—	4	13	1.3	9.4		
Ignition coil – cylinder head cover		Bolt	M6	4	7.6	0.76	5.5		
Cam position sensor – cylinder head cover		Bolt	M6	1	10	1.0	7.2		
Cooling water pipe – cylinder head	1st	Bolt	M6	1	3.7	0.37	2.7		
	2nd				7.6	0.76	5.5		
Cylinder head cover – cylinder head		Bolt	M6	6	12	1.2	8.7		
Timing chain tensioner cap bolt		Bolt	M6	1	10	1.0	7.2		
Timing chain tensioner – cylinder head		Bolt	M6	2	10	1.0	7.2		
Exhaust camshaft cap – cylinder head		Bolt	M6	10	10	1.0	7.2		
Intake camshaft cap – cylinder head		Bolt	M6	18	10	1.0	7.2		
Exhaust camshaft sprocket – exhaust camshaft		Bolt	M7	2	24	2.4	17		
Intake camshaft sprocket – intake camshaft		Bolt	M7	2	24	2.4	17		
Hanger – cylinder head		Bolt	M8	2	40	4.0	29		
Cylinder head – upper crankcase*1		Bolt	M6	3	10	1.0	7.2		
		1st	Nut	—	2	20	2.0	14	
						2nd	140 ± 5°		
		1st	Nut	—	2	20	2.0	14	
						2nd	121 ± 5°		
		1st	Nut	—	6	20	2.0	14	
2nd	105 ± 5°								
Plug (vacuum pressure)		Bolt	M6	4	10	1.0	7.2		
Engine temperature sensor – crankcase		—	—	1	15	1.5	11		

\*1 For details, refer to the tightening procedures in this manual.



## TIGHTENING TORQUES

Part to tightened	Part name	Thread size	Q'ty	Tightening torque			Remarks	
				N•m	kgf•m	ft•lb		
Thermoswitch (engine) – crankcase	Bolt	M6	2	7.6	0.76	5.5	 5/2	
Oil pressure switch	—	—	1	8.4	0.84	6.1	 5/2	
Anode cover – anode	Bolt	M6	1	12	1.2	8.7	 2/1	
Anode cover – upper crankcase	Bolt	M8	1	20	2.0	14		
Oil pan – lower crankcase	Bolt	M6	13	12	1.2	8.7	 5/2	
Lower crankcase – upper crankcase	Bolt	M6	10	12	1.2	8.7	 5/2	
	1st	Bolt	M9	10	7.8	0.78	5.6	 E
	2nd				Loosen completely			
	3rd				15	1.5	11	
	4th				49 ± 5°			
Oil pipe – lower crankcase	Bolt	M6	1	12	1.2	8.7	 E	
Oil filter bolt – lower crankcase	—	—	1	35	3.5	25	 E	
Connecting rod cap	1st	Nut	—	8	20	2.0	14	 M
	2nd				120 ± 5°			
Thermostat housing cover – Thermostat housing	1st	Bolt	M6	2	3.7	0.37	2.7	 5/2
	2nd				7.6	0.76	5.5	
Thermostat housing holder – oil tank	1st	Bolt	M6	2	3.7	0.37	2.7	 5/2
	2nd				7.6	0.76	5.5	
Grease nipple – thermostat housing cover	—	—	1	5.9	0.59	4.3	 5/2	
Jet pump unit								
Steering cable joint – jet thrust nozzle	Nut	—	1	6.8	0.68	4.9	 2/2	
Intake duct – hull	Bolt	M8	6	20	2.0	14	 2/2	
Intake grate – hull	Bolt	M8	3	20	2.0	14	 2/2	
Jet pump unit assembly/impeller housing 2 – transom plate	Bolt	M10	4	40	4.0	29	 5/2	
	Bolt	M6	1	7.8	0.78	5.6		





## TIGHTENING TORQUES

Part To Be Tightened	Part Name	Thread size	Qty	Tightening torque			Remarks
				N•m	kgf•m	ft•lb	
Water inlet cover/water inlet strainer - impeller duct	Bolt	M6	4	6.6	0.66	4.8	
Drive shaft nut - drive shaft	Nut	—	1	69	6.9	50	
Impeller (left-hand threads) – drive shaft	Impeller	M20	1	18	1.8	13	
Intermediate housing - bulkhead	Bolt	M8	3	17	1.7	12	
Driven coupling - shaft	Driven coupling	M24	1	36	3.6	25	
Grease nipple - intermediate housing	Nipple	—	1	5.4	0.54	3.9	
<b>Hull:</b>							
Steering cable locknut (jet thrust nozzle side)	Nut	—	1	6.5	0.65	4.7	
Steering cable grommet – hull	Nut	—	1	5.9	0.59	4.3	
Pilot water outlet - hull	Nut		2	4.2	0.42	3.0	
Engine mount – hull	Bolt	M8	8	17	1.7	12	
Engine damper – hull	Bolt	M6	4	6.4	0.64	4.6	
<b>Electrical:</b>							
Electrical box - bulk head	Bolt	M8	4	17	1.7	12	
Terminal cover - electrical box	Screw	M5	4	4.9	0.49	3.5	
Cover - electrical box	Tapping screw	ø5	18	4.9	0.49	3.5	
Starter motor lead - electrical box	Screw	M6	1	7.6	0.76	5.5	
Battery positive lead - electrical box	Screw	M6	1	7.6	0.76	5.5	
Fuse holder stay - electrical box	Tapping screw	ø6	1	3.9	0.39	2.8	
ECM - electrical box	Tapping screw	ø6	4	3.9	0.39	2.8	
Bracket (coupler) - electrical box	Tapping screw	ø6	1	3.9	0.39	2.8	

**TIGHTENING TORQUES**

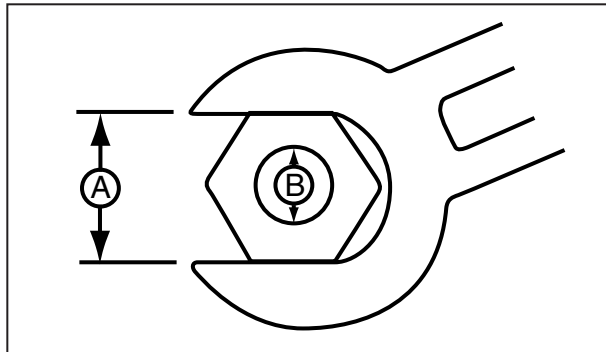
Part To Be Tightened	Part Name	Thread size	Qty	Tightening Torque			Remarks
				N•m	kgf•m	ft•lb	
Main and fuel pump relay	Tapping screw	ø6	1	3.9	0.39	2.8	
Rectifier/regulator	Tapping screw	ø6	2	3.9	0.39	2.8	
Ignition coil - oil tank	Bolt	M6	3	7.6	0.76	5.5	
Ignition coil cover - ignition coil case	Tapping screw	ø6	10	4.9	0.49	3.5	



Nut A	Bolt B	General Torque Specifications		
		Nm	M•kg	ft•lb
8 mm	M5	5.0	0.5	3.6
10 mm	M6	8.0	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	25
17 mm	M12	43	4.3	31

## GENERAL TORQUE

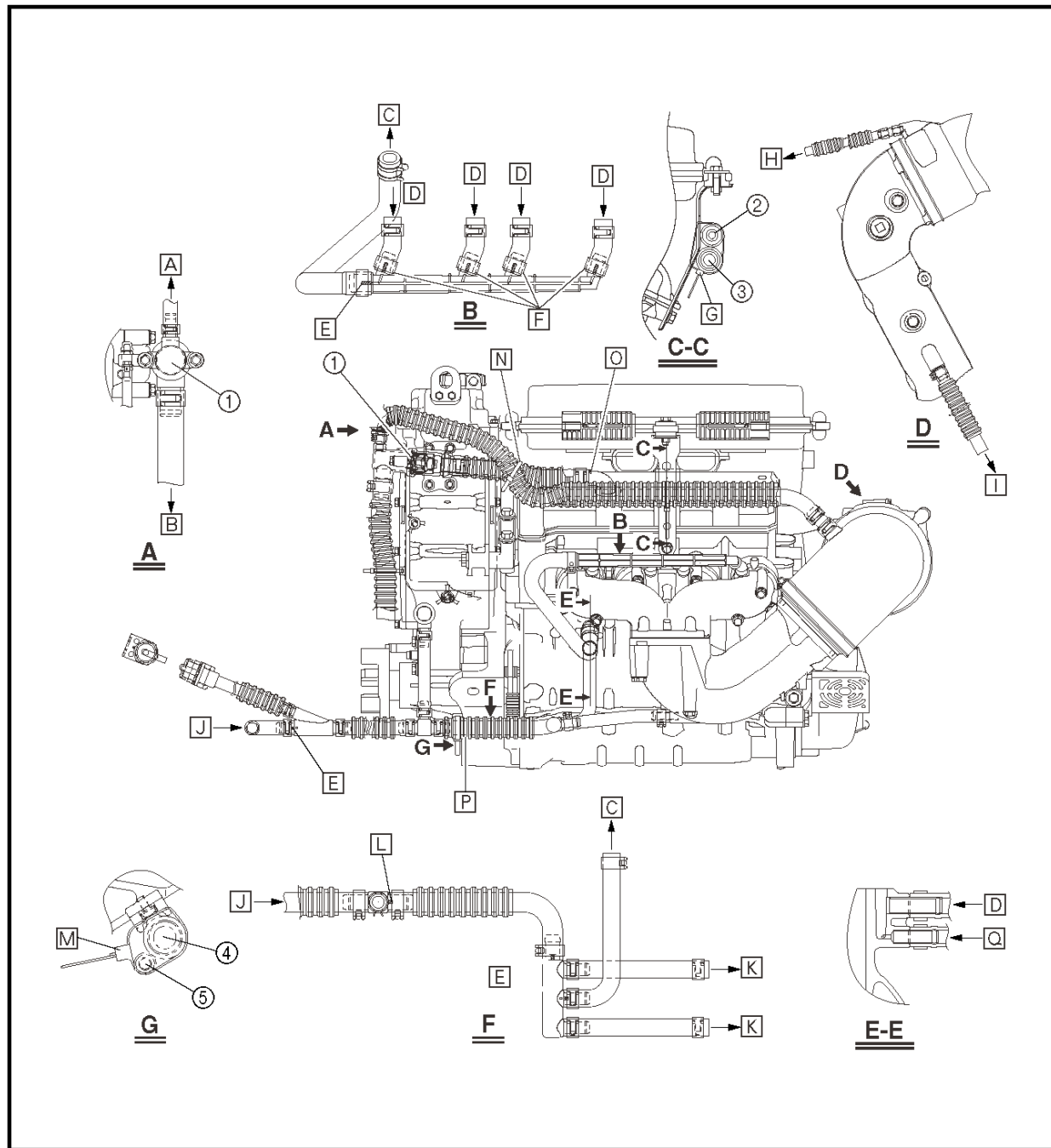
This chart specifies the torques for tightening standard fasteners with standard clean dry ISO threads at room temperature. Torque specifications for special components or assemblies are given in applicable sections of this manual. To avoid causing warpage, tighten multifastener assemblies in a criss-cross fashion, in progressive stages until the specified torque is reached.



Bolt Dia.	General Torque Specifications		
	Nm	M•kg	ft•lb
6-32	1.1	0.11	0.8
8-32	2.3	0.23	1.65
10-24	2.6	0.26	1.9
1/4-20	8.6	0.86	6.25
5/16-18	15	1.5	11.0



# CABLE AND HOSE ROUTING



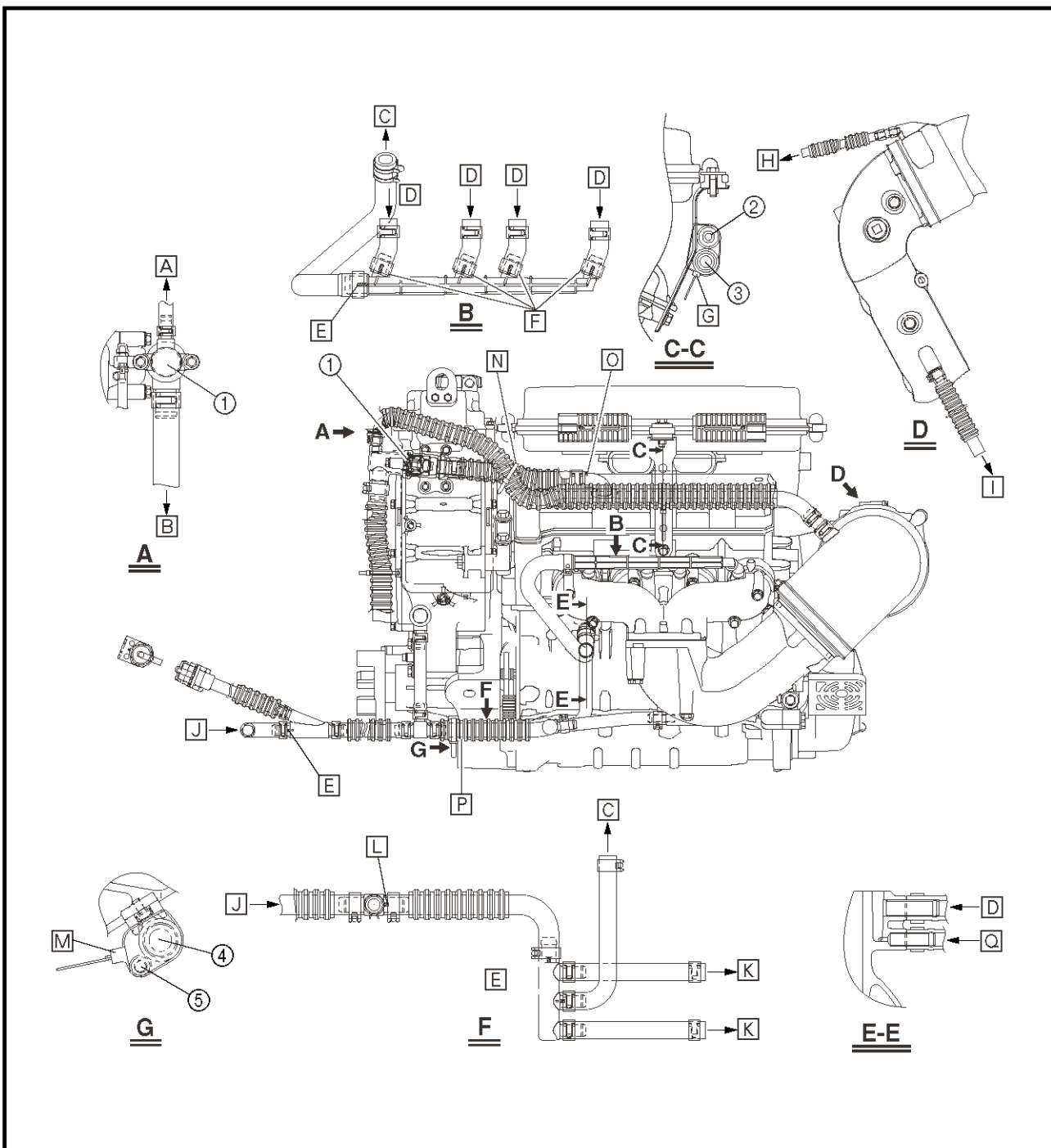
- ① Thermostat
- ② Cooling water pilot outlet hose
- ③ Cooling water hose
- ④ Cooling water hose (cooling water inlet)
- ⑤ Negative battery lead

- A To cooling water pilot outlet on starboard side
- B To cooling water outlet on starboard side of stern
- C To cylinder block
- D From exhaust manifold
- E To install the hose, align the white paint mark on the cooling water hose with the projection of the hose joint.

- F When installing the cooling water hoses, be sure to push them down until they contact the hose joint.



### CABLE AND HOSE ROUTING



**G** Bundle the cooling water pilot outlet hose and cooling water hoses, pass a plastic tie through the stay hole, and then fasten the tie. Set the tie in the direction shown.

**H** To cooling water pilot outlet on port side

**I** To cooling water outlet at stern

**J** Cooling water inlet

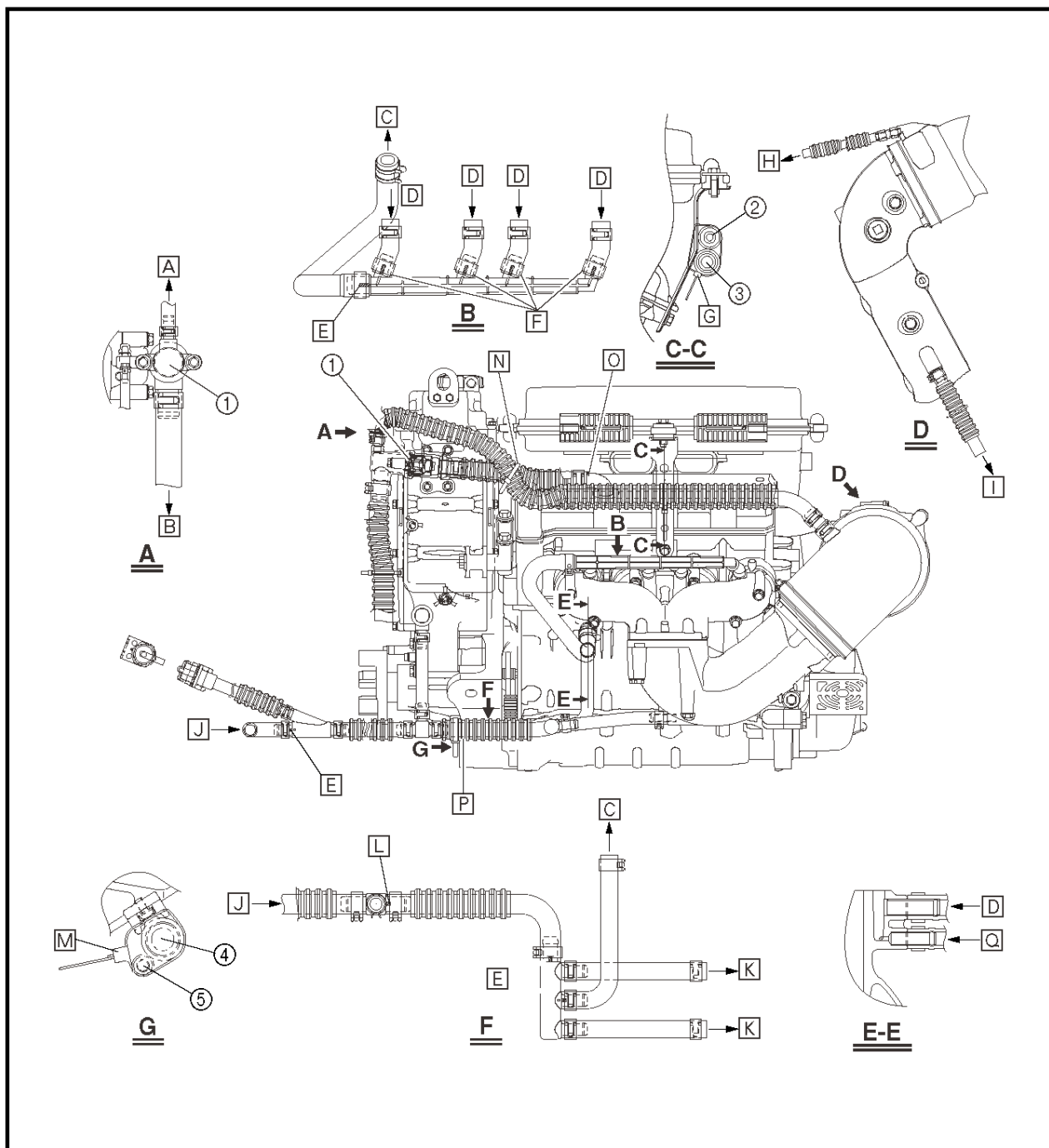
**K** To exhaust pipe

**L** To install the cooling water hose, align the white paint mark on the hose with the parting line on the hose joint.

**M** Fasten the cooling water hose and negative battery lead with a plastic tie. Set the tie in the direction shown.



## CABLE AND HOSE ROUTING



- N** Bundle the cooling water hose (cylinder head cover to thermostat) and cooling water hose (starboard cooling water pilot outlet), and then fasten them with a plastic tie to the oil tank boss. When bundling the hoses, make sure that the cooling water hose (cylinder head cover to thermostat) is routed on the deck side and that the cooling water hose (starboard cooling water pilot outlet) is routed on the engine side.

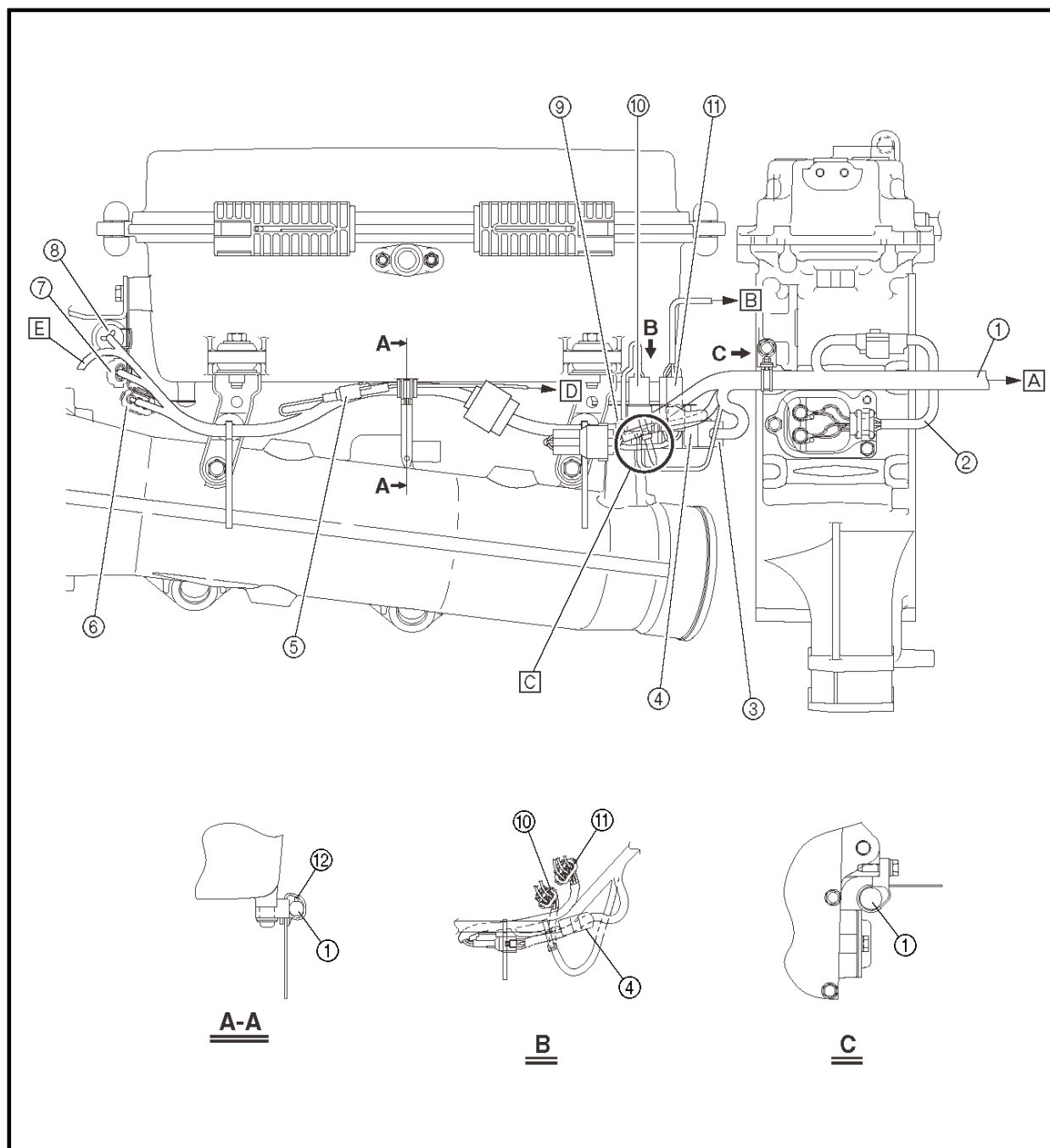
- O** Insert the cooling water hose to the paint mark.

- P** Fasten the end of the cooling water hose tube that is contacting the hose joint with a plastic tie.
- Q** Cooling water passage





### CABLE AND HOSE ROUTING



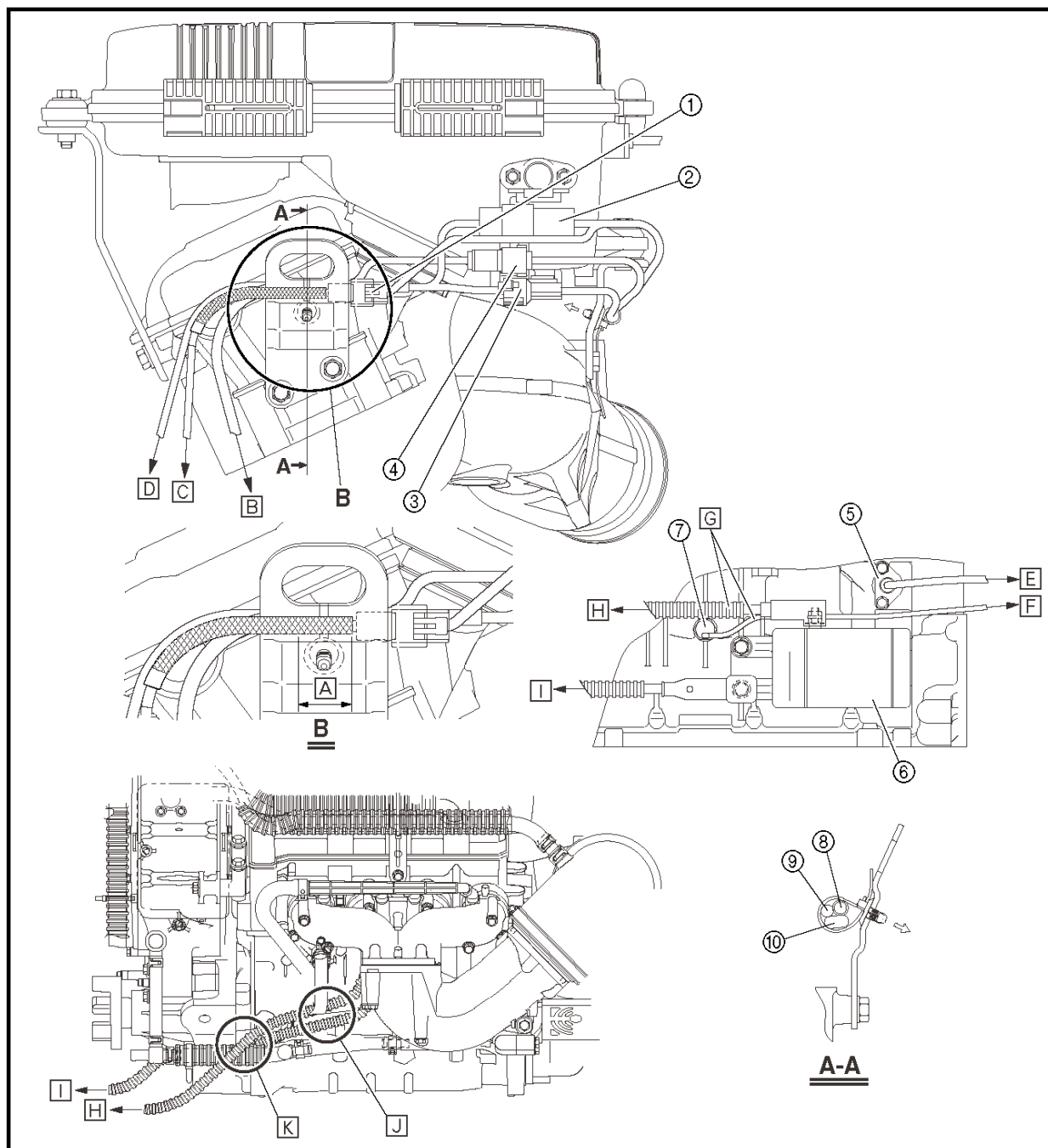
- ① Wiring harness
- ② Ground lead
- ③ Wiring harness coupler
- ④ Noise filter
- ⑤ Oil pressure switch coupler
- ⑥ Pickup coil coupler
- ⑦ Thermoswitch (engine) coupler
- ⑧ Lighting coil coupler
- ⑨ Thermoswitch (exhaust)
- ⑩ Thermoswitch (exhaust) coupler

- ⑪ Cam position sensor coupler
- ⑫ Oil pressure switch lead

- A To electrical box
- B To cam position sensor
- C Fasten the plastic tie with its end facing downward.
- D To oil pressure switch
- E To engine temperature sensor

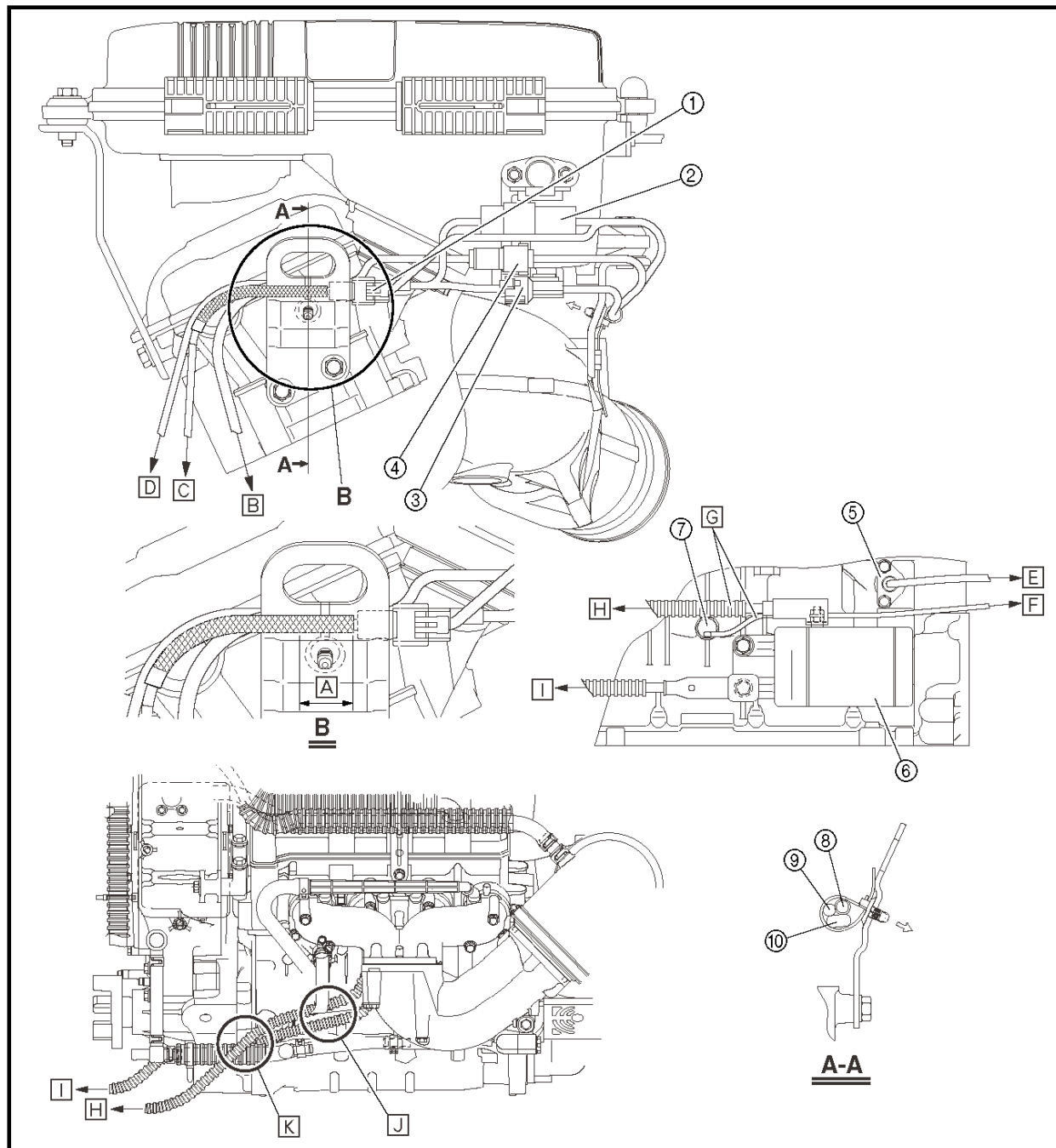


## CABLE AND HOSE ROUTING



- ① Engine temperature sensor coupler
- ② Lighting coil coupler
- ③ Pickup coil coupler
- ④ Thermoswitch (engine) coupler
- ⑤ Thermoswitch (engine)
- ⑥ Starter motor
- ⑦ Engine temperature sensor
- ⑧ Engine temperature sensor lead
- ⑨ Thermoswitch (engine) lead
- ⑩ Lighting coil lead

## CABLE AND HOSE ROUTING



- [A] Fasten the engine temperature sensor lead, thermoswitch lead, and lighting coil lead with a plastic tie. Fasten the engine temperature sensor lead 10–20 mm (0.4–0.8 in) from the end of the protective cover of the lead.
- [B] To generator
- [C] To engine temperature sensor
- [D] To thermoswitch (engine)
- [E] To thermoswitch (engine) coupler
- [F] To engine temperature sensor coupler
- [G] Route the starter motor lead to the outside of the engine temperature sensor lead.
- [H] To starter relay
- [I] To negative battery terminal
- [J] Route the starter motor and negative battery leads behind the cooling water hose.
- [K] Route the starter motor lead over the cooling water hose.

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## CHAPTER 3

### PERIODIC INSPECTION AND ADJUSTMENT

<b>MAINTENANCE INTERVAL CHART</b> .....	3-1
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<b>POWER UNIT</b> .....	3-7
<b>JET PUMP UNIT</b> .....	3-21
<b>BILGE PUMP</b> .....	3-22
<b>GENERAL</b> .....	3-24



### MAINTENANCE INTERVAL CHART

The following chart should be considered strictly as a guide to general maintenance intervals. Depending on operating conditions, the intervals of maintenance should be changed.

(●) This mark indicates maintenance that you may do yourself.

(○) This mark indicates work to be done by a Yamaha dealer.

MAINTENANCE INTERVAL  ITEM		INITIAL			THEREAFTER EVERY	
		10 hours	50 hours	100 hours	100 hours	200 hours
			6 months	12 months	12 months	24 months
Spark plug	Inspect, clean, adjust	●	●	●	●	
Lubrication points	Lubricate			●	●	
Intermediate housing	Lubricate	○*1		●*2	●*2	
Fuel system	Inspect			○	○	
Fuel tank	Clean			○	○	
Fuel filter	Inspect, clean			○	○	
Trolling speed	Inspect	○		○	○	
Throttle shaft	Inspect			○	○	
Cooling water passages	Flush	● (after every use)				
Water inlet strainer	Inspect, clean			○	○	
Electric bilge pump strainer	Inspect, clean			○	○	
Impeller	Inspect		●	●	●	
Steering cable	Inspect		●	●	●	
Steering master	Inspect	○		○	○	
Shift cable and mechanism	Inspect, adjust			○	○	
Throttle cable	Inspect, adjust			●	●	
Stern drain plugs	Inspect, replace			○	○	
Battery	Inspect	● (inspect fluid level before every use)		○	○	
Rubber coupling	Inspect					○
Engine mount	Inspect					○
Nuts and bolts	Inspect	○		○	○	
Air filter	Inspect					●
Engine oil	Replace	○		○	○	
Engine oil filter	Replace					○
Valve clearance	Inspect, adjust					○

\*1: Grease capacity: 33.0–35.0 cm<sup>3</sup> (1.11–1.18 oz)

\*2: Grease capacity: 6.0–8.0 cm<sup>3</sup> (0.20–0.27 oz)

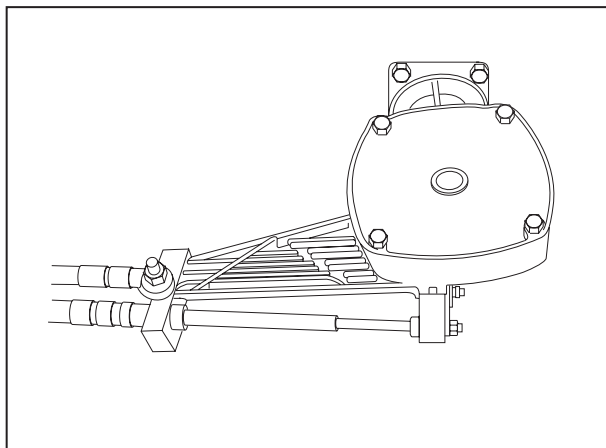


## PERIODIC SERVICE

### CONTROL SYSTEM

#### Steering helm inspection

1. Check:
  - Friction  
Excessively heavy →  
Replace the steering helm unit.
2. Check:
  - Free play  
Excessive free play →  
Replace the steering helm unit.



#### Steering cable adjustment

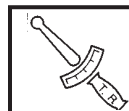
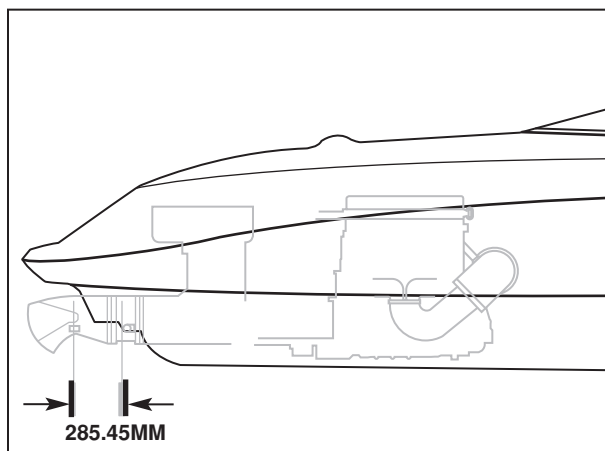
1. Measure:
  - Distance between the center of the steering nozzle joint and the cooling water casting boss on the right side of the pump. Incorrect distance → Adjust steering cable joint at nozzle end.



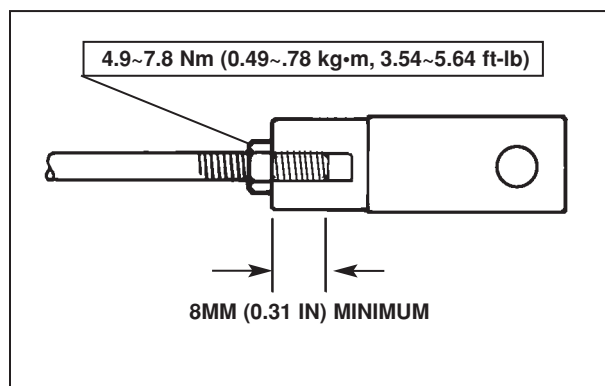
**Steering Adjustment Distance:**  
11.24 in (285.45mm)

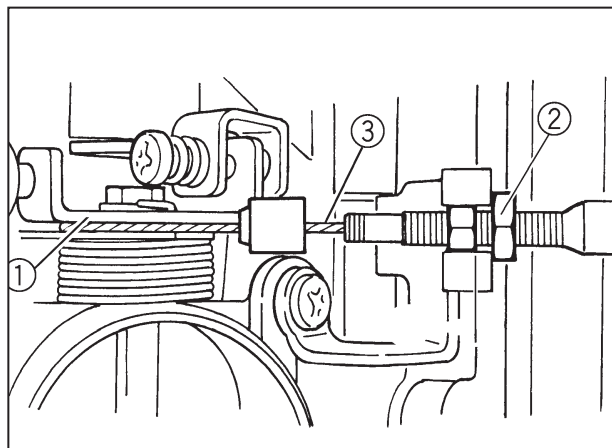
#### **⚠ WARNING**

The cable joints must be screwed in more than 8mm (0.31 in).



**Lock Nut: 4.9 ~ 7.8Nm**  
(0.49~0.78 kg-m, 3.54~5.64 ft-lb)





- ① Cable Wheel
- ② Locknuts
- ③ Throttle Cable

### REMOTE CONTROL UNIT

#### Throttle Cables

1. Remove:
  - Airbox cover.
2. Set:
  - Remote Control levers to Neutral position.
3. Check:
  - Throttle Cable Wheel ① should contact the idle screw and there should be free play in the cable.
  - If adjustment is necessary, loosen the Locknuts ② at the throttle body end and turn the cable adjuster.
4. Tighten:
  - Locknuts ② when adjustment is complete.

#### Adjust Throttle Lever Stops:

1. Remove:
  - Four screws holding the remote control unit cover.
2. Set:
  - Remote control levers forward to the Forward Wide-Open-Throttle (W.O.T.) position.
3. Check:
  - Each throttle cable at the throttle body assemblies so that the Cable wheel has 0.001" (0.025mm) to 0.079" (2.0mm) clearance to the Stop. If incorrect → Adjust.
4. Adjust:
  - Cable-Wheel-to-Stop clearance with the Forward Throttle Stop bolts on the Remote Control unit.

#### CAUTION:

**Be careful not to over-adjust, as the throttle bodies can be damaged.**





5. Tighten:
  - Forward Throttle Stop bolt lock nuts.  
6.8 Nm (0.7 kgf-m, 5 ft-lb)

**CAUTION:**

Do not allow the Throttle Stop bolts to project 8mm (0.31") or more from the top of the lock nuts. Otherwise, the Stop bolt will contact the remote control unit cover.

6. Install:
  - Air box cover.

**Shift Cables**

1. Set:
  - Remote Control levers to Neutral position.
2. Check:
  - Ball Joints on steering cable ends so the joint has at least 8mm (0.31 in.) of thread engagement on the shift cable ①.
3. Adjust:
  - Shift cable Ball Joint so that Reverse Gate is open to:  
A =  $30 \pm 2\text{mm}$  ( $1.18 \pm 0.05\text{in.}$ )

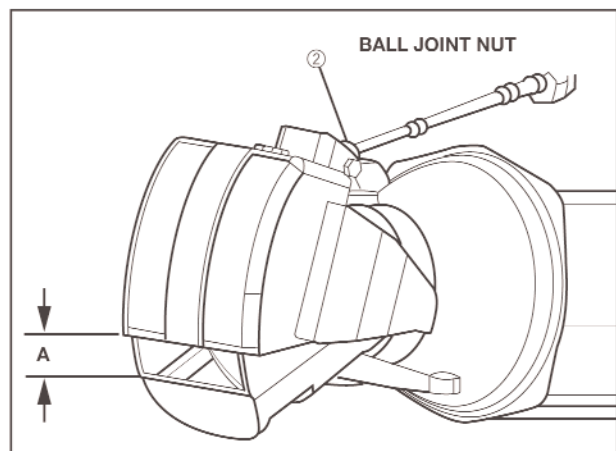
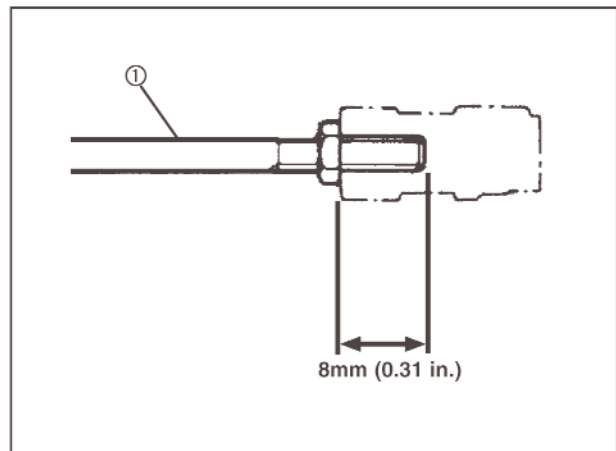
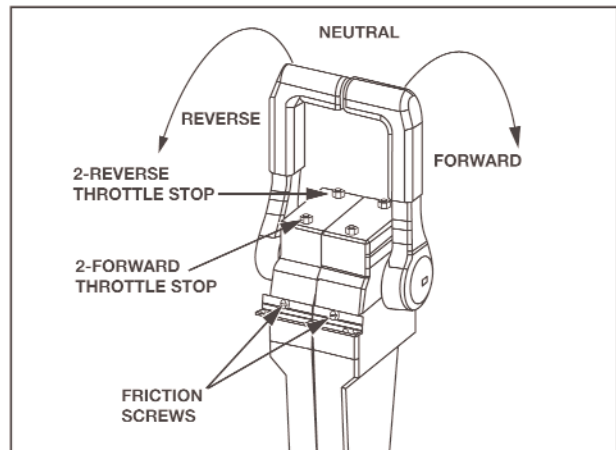
**⚠ WARNING**

The cable joints must have at least 8mm (0.31 in.) engagement on the shift cable threads after adjustment is complete.

4. Tighten:
  - Ball Joint lock nut ②.  
2.8 Nm (0.29 kgf-m, 2.1 ft-lb)

**Adjust Reverse Lever Stops**

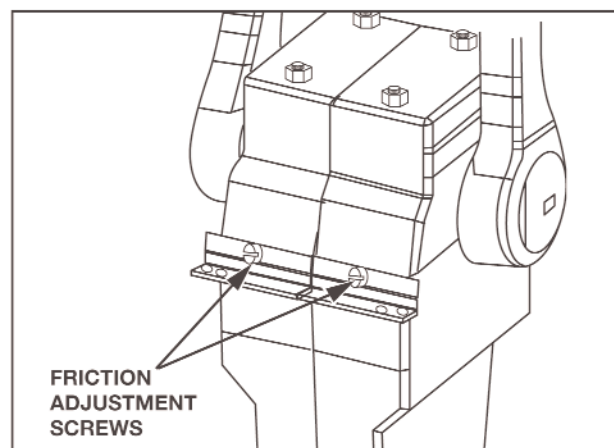
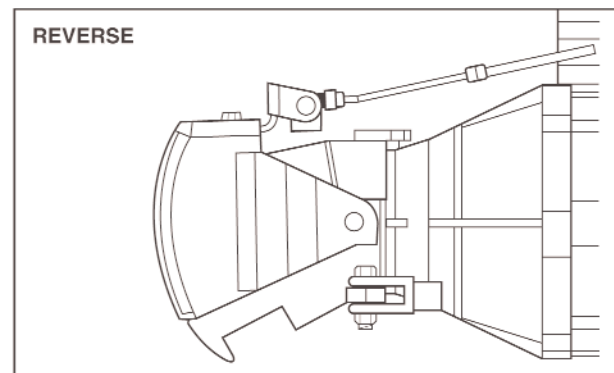
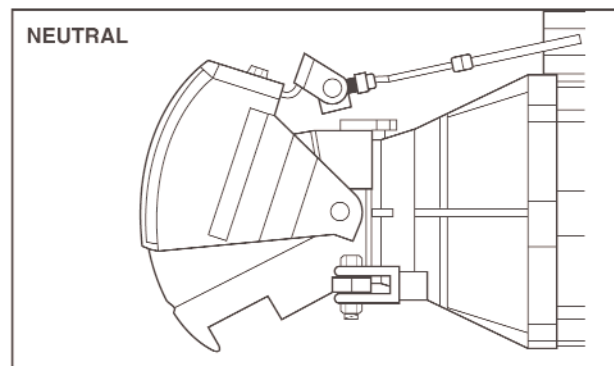
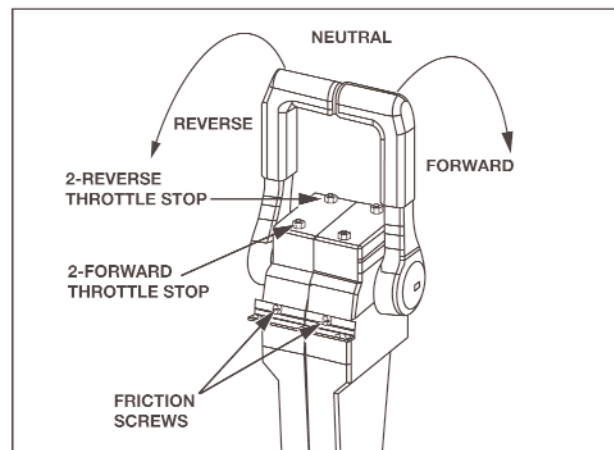
1. Set:
  - Remote Control levers in Reverse until the levers stop in the full Reverse position.
2. Check:
  - Both Reverse gates are fully closed over the jet pump nozzle.



3. Adjust:
  - Reverse Throttle Stop bolts if the reverse gate is out of specification.
4. Tighten:
  - Reverse Throttle Stop bolt lock nuts. 6.8 Nm (0.7 kgf-m, 5 ft-lb)

### CAUTION:

Do not allow the Throttle Stop bolts to project 8mm (0.31 in.) or more from the top of the lock nuts. Otherwise, the Stop bolt will contact the remote control unit cover.



### Remote Control Lever Friction Settings

1. Check:
  - Both Remote Control levers through full movement to make sure they operate Smoothly and that they stay in any position set. Incorrect → Adjust
2. Adjust:
  - Set the Remote Control levers in Neutral position.
  - Turn the Friction Adjustment Screws counterclockwise four complete turns.
  - Then, turn screws clockwise until you feel them start to snug.
  - Recheck both levers through full movement to make sure they operate smoothly and that they stay in any position set.
3. Install:
  - Remote Control unit cover. 1.9 Nm (0.2 kgf-m, 1.4 ft-lb)

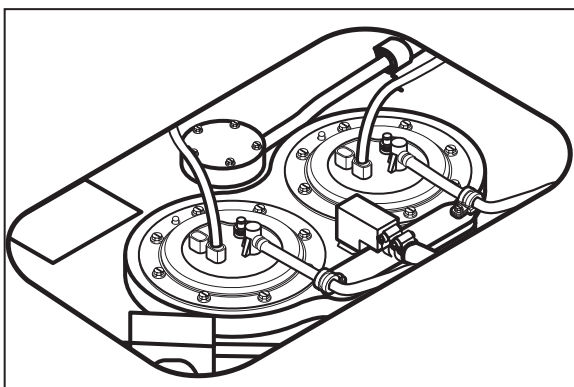


## FUEL SYSTEM

### **⚠ WARNING**

When removing fuel system parts, wrap them in a cloth and take care that no fuel spills into the engine compartment.

---



### Fuel line inspection

#### 1. Inspect:

- Fuel pump filter  
Clog/contaminants → Clean.  
Refer to “FUEL TANK AND FUEL PUMP MODULE” in Chapter 4.
- Fuel hose  
Damage/cracks → Replace.
- O-rings (quick connector)  
Damage/cracks → Replace the quick connector.
- Fuel pipe  
Damage/cracks → Replace the fuel pump.  
Refer to “FUEL INJECTION SYSTEM” in Chapter 4.
- Fuel filler hose
- Fuel tank
- Fuel filler cap  
Cracks/damage → Replace.



### POWER UNIT

#### Valve clearance adjustment

The following procedure applies to all of the valves.

#### NOTE:

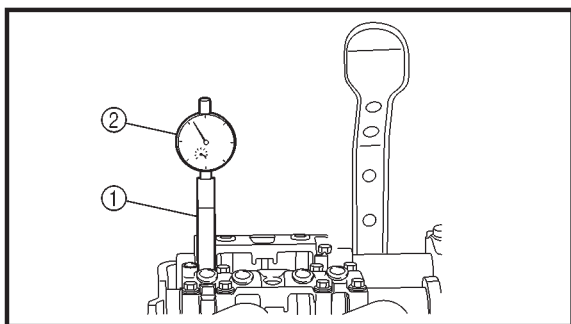
- Valve clearance adjustment should be made on a cold engine at room temperature.
- When the valve clearance is to be measured or adjusted, the piston must be at Top Dead Center (TDC) on the compression stroke.

#### 1. Remove:

- Air filter case  
Refer to "FUEL INJECTION SYSTEM" in Chapter 4.

#### 2. Remove:

- Spark plugs
- Cylinder head cover
- Cylinder head cover gasket  
Refer to "CAMSHAFTS" in Chapter 5.



#### 3. Install:

- Dial gauge needle
- Dial gauge stand ①  
(into spark plug hole #1)
- Dial gauge ②

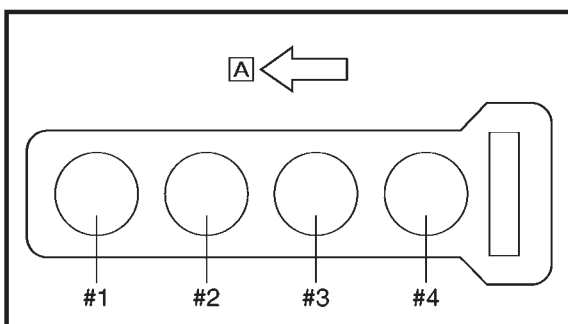
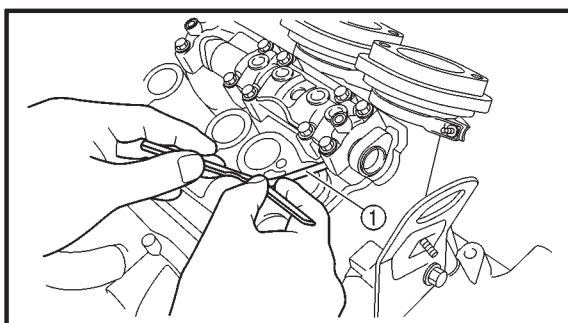
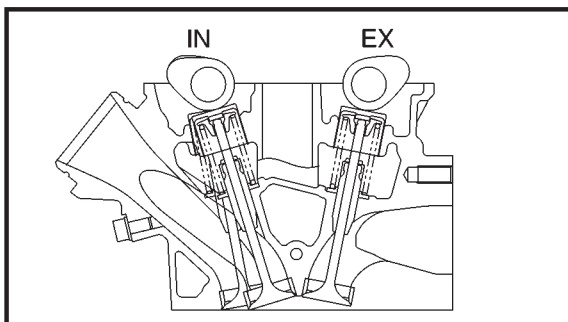
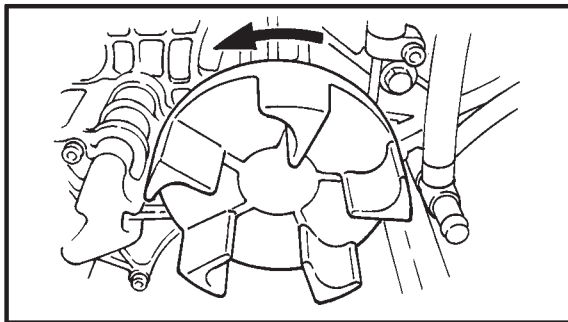


**Dial gauge stand:**  
90890-06583

**Dial gauge needle:**  
90890-06584

**Dial gauge stand set:**  
YW-06585/90890-06585

**Dial gauge:**  
YU-03097/90890-01252



[B] →		0°	180°	360°	540°	720°
[C]	#1	[D]				
	#2		[D]			
	#3				[D]	
	#4			[D]		

## 4. Measure:

- Valve clearance
- Out of specification → Adjust.

**Valve clearance (cold):****Intake valve:**

0.11–0.20 mm  
(0.0043–0.0079 in)

**Exhaust valve:**

0.25–0.34 mm  
(0.0098–0.0134 in)

**Measurement steps:**

- Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.

**NOTE:**

TDC on the compression stroke can be found when the camshaft lobes are turned away from each other.

- Measure the valve clearance with a thickness gauge ①.

**NOTE:**

- If the valve clearance is incorrect, record the measured reading.
- Measure the valve clearance in the following sequence.

**Valve clearance measuring sequence**

**Cylinder #1 → #2 → #4 → #3**

## [A] Bow side

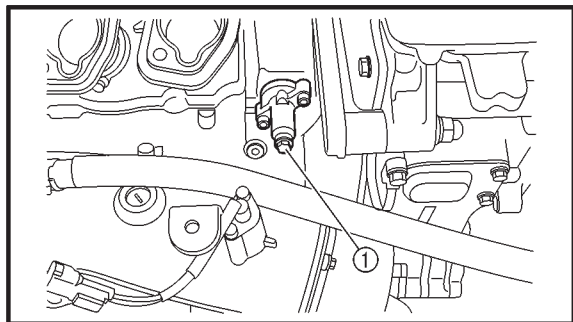
- To measure the valve clearances of the other cylinders, starting with cylinder #1 at TDC, turn the drive coupling counterclockwise as specified in the following table.

[B] Degrees that the crankshaft is turned clockwise

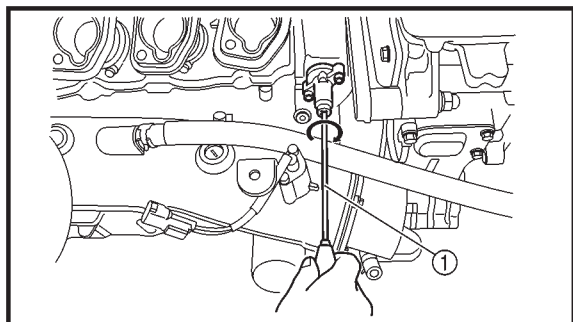
[C] Cylinder

[D] Combustion cycle

<b>Cylinder #2</b>	<b>180°</b>
<b>Cylinder #4</b>	<b>360°</b>
<b>Cylinder #3</b>	<b>540°</b>



5. Remove:
- Timing chain tensioner cap bolt ①
  - Gasket

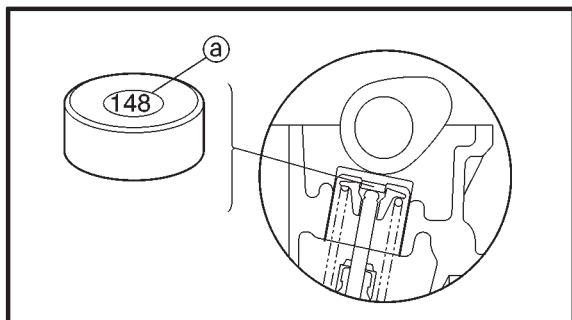
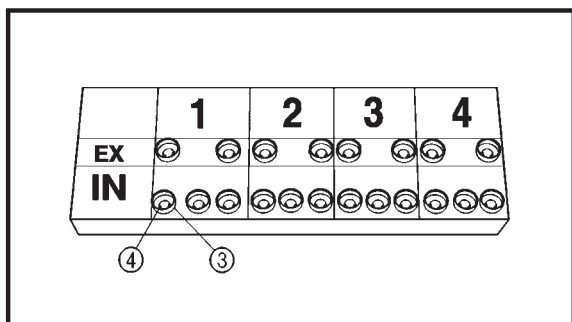
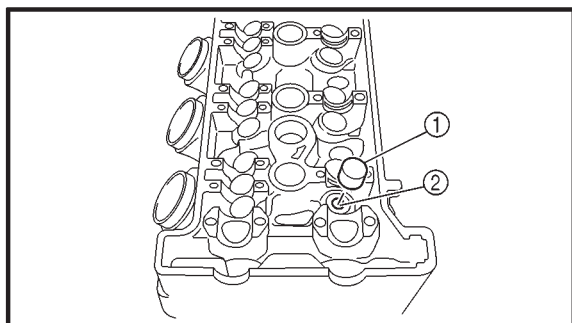


6. Turn the timing chain tensioner rod fully clockwise with a thin screwdriver ①.

**NOTE:** \_\_\_\_\_  
Make sure that the tensioner rod has been fully set clockwise.  
\_\_\_\_\_

7. Remove:
- Intake camshaft caps
  - Exhaust camshaft caps
  - Timing chain  
(from the camshaft sprockets)
  - Intake camshaft
  - Exhaust camshaft

**NOTE:** \_\_\_\_\_  
• Refer to "CAMSHAFTS" in Chapter 5.  
• When removing the timing chain and camshafts, fasten the timing chain with a wire to prevent it from falling into the crankcase.  
\_\_\_\_\_



## 8. Adjust:

- Valve clearance

**Adjustment steps:**

- Remove the valve lifter ① and the valve pad ②.

**NOTE:**

- Cover the timing chain opening with a rag to prevent the valve pad from falling into the crankcase.
- Make a note of the position of each valve lifter ③ and valve pad ④ so they can be installed in the correct place.

- Select the proper valve pad from the following table:

Valve pad thickness range		Available valve pads
Nos.	1.20–2.40 mm	25 thicknesses in 0.05 mm increments

**NOTE:**

- The thickness ① of each valve pad is marked in hundredths of millimeters on the side that touches the valve lifter.
- Since valve pads of various sizes are originally installed, the valve pad number must be rounded in order to reach the closest equivalent to the original.
- Round off the original valve pad number according to the following table.

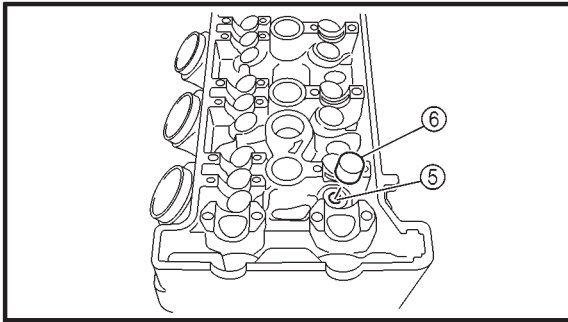
Last digit	Rounded value
0 or 2	0
5	5
8	10

**EXAMPLE:**

Original valve pad number = 148 (thickness = 1.48 mm)

Rounded value = 150

- Locate the rounded number of the original valve pad and the measured valve clearance in the valve pad selection table. The point where the column and row intersect is the new valve pad number.



### NOTE:

The new valve pad number is only an approximation. The valve clearance must be measured again and the above steps should be repeated if the measurement is still incorrect.

- Install the new valve pad ⑤ and the valve lifter ⑥.

### NOTE:

- Lubricate the valve pad with molybdenum disulfide grease.
- Lubricate the valve lifter with molybdenum disulfide oil.
- The valve lifter must turn smoothly when rotated by hand.
- Install the valve lifter and the valve pad in the correct place.
- Install the exhaust and intake camshafts, timing chain and camshaft caps.



**Camshaft cap bolt:**  
10 N • m (1.0 kgf • m, 7.2 ft • lb)

### NOTE:

- Refer to “Camshaft installation — CAM-SHAFTS” in Chapter 5.
- Lubricate the camshafts, camshaft lobes and camshaft journals.
- First, install the exhaust camshaft.
- Align the camshaft marks with the camshaft cap marks.
- Turn the crankshaft clockwise several full turns to seat the parts.
- Measure the valve clearance again.
- If the valve clearance is still out of specification, repeat all of the valve clearance adjustment steps until the specified clearance is obtained.





## Intake

MEASURED CLEARANCE	ORIGINAL VALVE PAD NUMBER																									
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	
0.00–0.02					120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225
0.03–0.07				120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230
0.08–0.10			120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235
0.11–0.20	STANDARD CLEARANCE																									
0.21–0.22	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240		
0.23–0.27	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240			
0.28–0.32	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240				
0.33–0.37	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240					
0.38–0.42	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240						
0.43–0.47	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240							
0.48–0.52	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240								
0.53–0.57	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240									
0.58–0.62	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240										
0.63–0.67	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240											
0.68–0.72	175	180	185	190	195	200	205	210	215	220	225	230	235	240												
0.73–0.77	180	185	190	195	200	205	210	215	220	225	230	235	240													
0.78–0.82	185	190	195	200	205	210	215	220	225	230	235	240														
0.83–0.87	190	195	200	205	210	215	220	225	230	235	240															
0.88–0.92	195	200	205	210	215	220	225	230	235	240																
0.93–0.97	200	205	210	215	220	225	230	235	240																	
0.98–1.02	205	210	215	220	225	230	235	240																		
1.03–1.07	210	215	220	225	230	235	240																			
1.08–1.12	215	220	225	230	235	240																				
1.13–1.17	220	225	230	235	240																					
1.18–1.22	225	230	235	240																						
1.23–1.27	230	235	240																							
1.28–1.32	235	240																								
1.33–1.37	240																									

Example:

Intake valve clearance (cold)

0.11–0.20 mm (0.0043–0.0079 in)

Rounded value 150

Measured valve clearance is 0.24 mm (0.0094 in)

Replace pad 150 with pad 160

Pad No. 150 = 1.50 mm (0.0591 in)

Pad No. 160 = 1.60 mm (0.0630 in)

Example:

Intake valve clearance (cold)

0.11–0.20 mm (0.0043–0.0079 in)

Rounded value 150

Measured valve clearance is 0.24 mm (0.0094 in)

Replace pad 150 with pad 160

Pad No. 150 = 1.50 mm (0.0591 in)

Pad No. 160 = 1.60 mm (0.0630 in)

## Exhaust

MEASURED CLEARANCE	ORIGINAL VALVE PAD NUMBER																								
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240
0.00–0.01							120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
0.02–0.06						120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215
0.07–0.11				120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	
0.12–0.16			120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	
0.17–0.21		120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	
0.22–0.24	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	
0.25–0.34	STANDARD CLEARANCE																								
0.35–0.37	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	
0.38–0.42	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240		
0.43–0.47	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240			
0.48–0.52	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240				
0.53–0.57	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240					
0.58–0.62	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240						
0.63–0.67	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240							
0.68–0.72	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240								
0.73–0.77	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240									
0.78–0.82	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240										
0.83–0.87	175	180	185	190	195	200	205	210	215	220	225	230	235	240											
0.88–0.92	180	185	190	195	200	205	210	215	220	225	230	235	240												
0.93–0.97	185	190	195	200	205	210	215	220	225	230	235	240													
0.98–1.02	190	195	200	205	210	215	220	225	230	235	240														
1.03–1.07	195	200	205	210	215	220	225	230	235	240															
1.08–1.12	200	205	210	215	220	225	230	235	240																
1.13–1.17	205	210	215	220	225	230	235	240																	
1.18–1.22	210	215	220	225	230	235	240																		
1.23–1.27	215	220	225	230	235	240																			
1.28–1.32	220	225	230	235	240																				
1.33–1.37	225	230	235	240																					
1.38–1.42	230	235	240																						
1.43–1.47	235	240																							
1.48–1.52	240																								

Example:

Exhaust valve clearance (cold)

0.25–0.34 mm (0.0098–0.0134 in)

Rounded value 170

Measured valve clearance is 0.44 mm (0.0173 in)

Replace pad 170 with pad 185

Pad No. 170 = 1.70 mm (0.0669 in)

Pad No. 185 = 1.85 mm (0.0728 in)

Example:

Exhaust valve clearance (cold)

0.25–0.34 mm (0.0098–0.0134 in)

Rounded value 170

Measured valve clearance is 0.44 mm (0.0173 in)

Replace pad 170 with pad 185

Pad No. 170 = 1.70 mm (0.0669 in)

Pad No. 185 = 1.85 mm (0.0728 in)



9. Remove:

- Dial gauge
- Dial gauge stand
- Dial gauge needle

10. Install:

- All removed parts

**NOTE:** \_\_\_\_\_

For installation, reverse the removal procedure.

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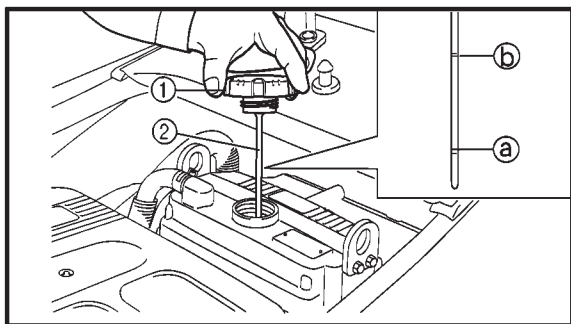
### Engine oil level check

1. Place the watercraft in a horizontal position.
2. Check:
  - Engine oil level

#### Checking steps:

**CAUTION:** \_\_\_\_\_

- When checking the oil level in water, stay clear of other boats. The watercraft could be drifted away by the current or wind.
  - Do not run the engine for more than 15 seconds without supplying water when checking the oil level on land. The engine could overheat.
  - Do not run the engine with too much or not enough oil in the oil tank. Oil could spray out or the engine could be damaged.
-



- Remove the oil filler cap ① and check for oil on the dipstick ②.
- If there is no oil on the dipstick, pour enough oil so that the tip of the dipstick comes into contact with the oil, and then install the filler cap.
- **In water**
  - a. Place the craft in water, and then start the engine.
  - b. Run the engine at 7,000 r/min or more for more than 5 minutes.
  - c. Run the engine at trolling speed for 2–3 minutes.
  - d. Stop the engine.
- **On land**
  - a. Connect the flushing hose connector to the watercraft.
  - b. Start the engine, and then turn on the water supply.
  - c. Run the engine at trolling speed for 6–8 minutes.
  - d. Turn the water supply off, and then stop the engine.

**CAUTION:**

**When checking the oil level on land, be sure to connect a garden hose to the watercraft for proper water supply.**

**NOTE:**

If the ambient temperature is less than 15 °C (59 °F), run the engine for an additional 5 minutes.

- Remove the oil filler cap ①, wipe the dipstick ② clean, insert it back into the filler hole, and then remove it again to check the oil level.

**NOTE:**

The engine oil should be between the minimum level mark ④ and maximum level mark ⑤.



- If the engine oil is below the minimum level mark ①, add sufficient oil of the recommended type to raise it to the correct level.
- If the engine oil is above the maximum level mark ②, extract sufficient oil using an oil changer to lower it to the correct level.

### NOTE:

If the oil temperature is low, the reading on the dipstick will be low. If the temperature is high, the reading on the dipstick will be high.

## Engine oil change — using oil changer

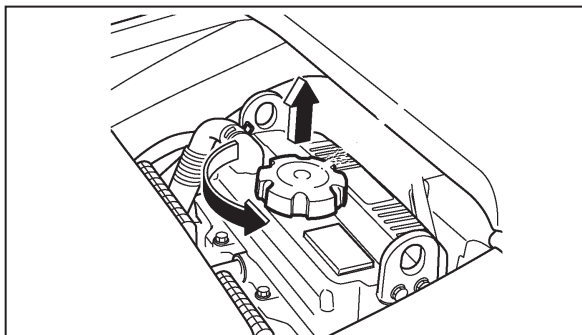
### ⚠ WARNING

Avoid changing the engine oil immediately after turning the engine off. The oil is hot and should be handled with care to avoid burns.

### CAUTION:

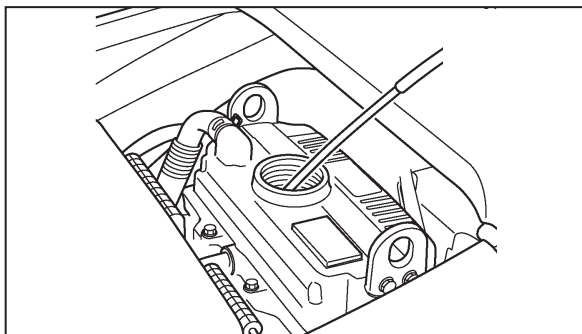
- Do not run the engine with too much or not enough oil in the oil tank. Oil could spray out or the engine could be damaged.
- Do not run the engine for more than 15 seconds without supplying water when checking the oil level on land. The engine could overheat.
- Be sure to change the engine oil after the first 10 hours of operation, and every 100 hours thereafter or at the start of a new season, otherwise the engine will wear quickly.

1. Warm the engine up, and then put the craft in a horizontal position.



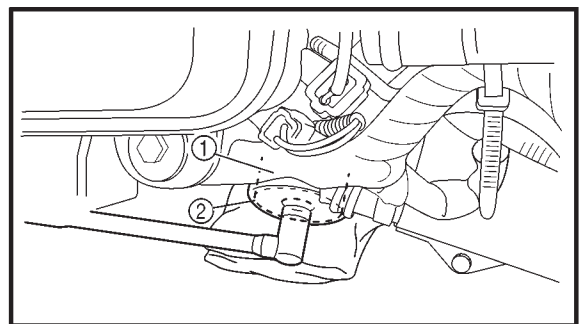
2. Remove:

- Oil filler cap ①



3. Insert the tube of an oil changer into the oil filler hole.

4. Operate the oil changer to extract the oil.



5. If the oil filter is also to be replaced, perform the following procedure.

#### Replacing steps:

- Place a rag under the oil filter.
- Remove the oil filter ① with an oil filter wrench ②.



**Oil filter wrench:**  
YU-38411/90890-01426

- Lubricate the O-ring ③ of the new oil filter with a thin coat of engine oil.

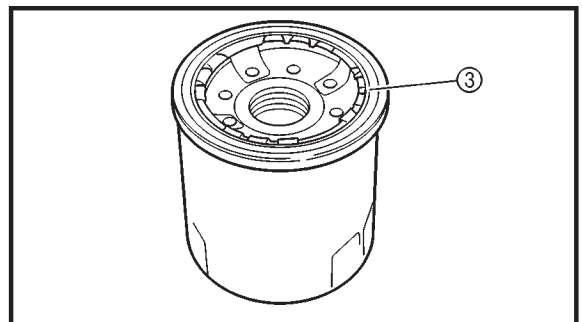
#### CAUTION:

**Make sure the O-ring ③ is positioned correctly in the groove of the oil filter.**

- Tighten the new oil filter to specification with an oil filter wrench.



**Oil filter:**  
17 N • m (1.7 kgf • m, 12 ft • lb)





6. Pour the specified amount of the recommended engine oil into the oil filler hole.

7. Fill:

- Oil tank  
(with the specified amount of the recommended engine oil)



**Recommended oil:**

**SAE 10W-30**

**API SE, SF, SG, SH, SJ**

**Oil quantity:**

**Total amount:**

**4.3 L (4.5 US qt, 3.8 Imp qt)**

**With oil filter replacement:**

**2.2 L (2.3 US qt, 1.9 Imp qt)**

**Without oil filter replacement:**

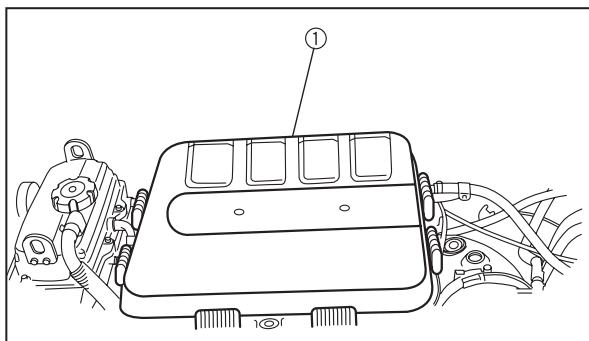
**2.0 L (2.1 US qt, 1.8 Imp qt)**

### **CAUTION:**

When starting the engine, make sure the dipstick is securely fitted into the oil tank.

8. Install:

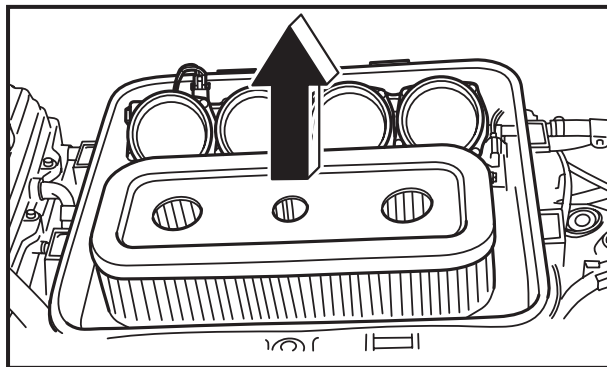
- Oil filler cap



### **Air filter element clean**

1. Remove:

- Air filter case cover ①



2. Remove the air filter element and check it for dirt and oil. Replace the air filter element if there is any oil buildup.

**CAUTION:**

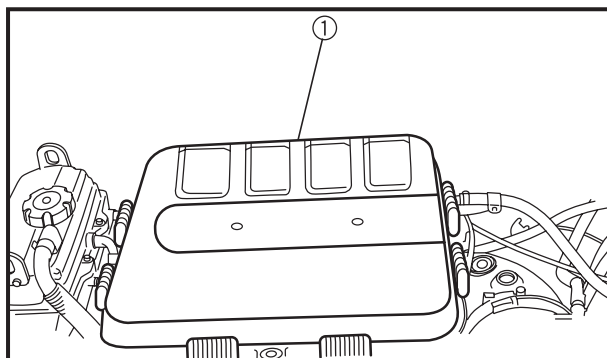
- Make sure the air filter element is installed in the filter case properly.
- Do not start the engine with the air filter element removed, otherwise the engine could be damaged.
- If cleaning the air filter element, use cold or lukewarm water and let it air dry completely. Do not use detergent or a solvent to clean the air filter element, or dry it with heat or compressed air, otherwise it could be damaged.

## 3. Install:

- Air filter case cover

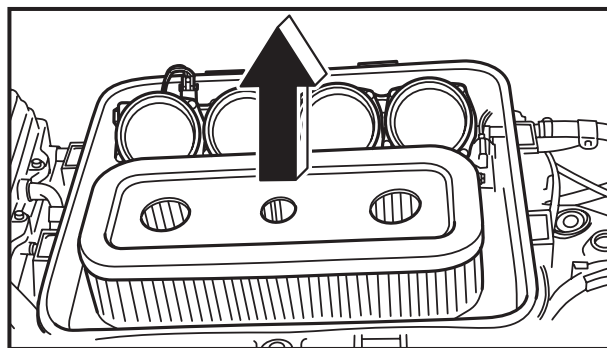


**Air filter case cover screw:**  
 2.5 N • m (0.25 kgf • m, 1.8 ft • lb)  
 LOCTITE® 572

**Spark plug inspection**

## 1. Remove:

- Air filter case cover

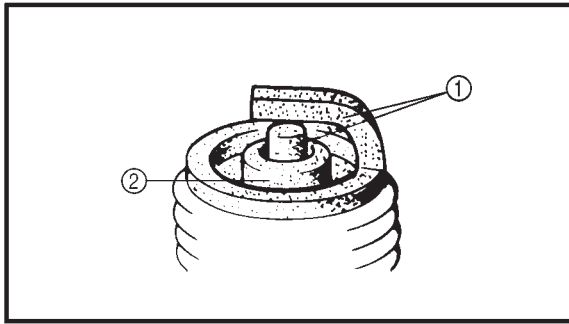


## 2. Remove:

- Air filter element

**CAUTION:**

Be careful not to get any foreign substances or water in the air intake port and spark plug hole.



### 3. Inspect:

- Electrodes ①  
Damage/wear → Replace.
- Insulator color ②  
Distinctly different color → Check the engine condition.



#### Color guide:

**Medium to light tan color:**

**Normal**

**Whitish color:**

**Lean fuel mixture**

**Air leak**

**Incorrect settings**

**Blackish color:**

**Overly rich mixture**

**Electrical malfunction**

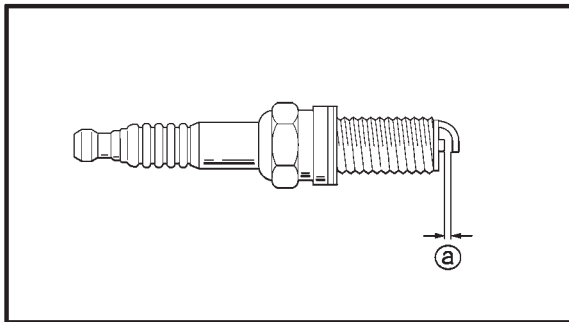
**Defective spark plug**

### 4. Clean:

- Spark plug  
(with a spark plug cleaner or wire brush)

### 5. Measure:

- Spark plug gap ③  
Out of specification → Regap.



#### Spark plug gap:

**0.7–0.8 mm (0.028–0.031 in)**

### 6. Tighten:

- Spark plug

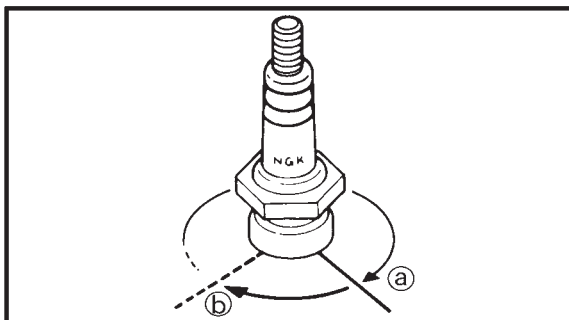


#### Spark plug:

**13 N • m (1.3 kgf • m, 9.4 ft • lb)**

### NOTE:

- Before installing the spark plug, clean the gasket surface and spark plug surface. Also, it is suggested to apply a thin film of anti-seize compound to the spark plug threads to prevent thread seizure.
- If a torque wrench is not available, a good estimate of the correct tightening torque for a new spark plug is to finger tighten ④ the spark plug and then tighten it another 1/4 to 1/2 of a turn ⑤.







7. Install:

- Air filter element
- Air filter case cover



**Air filter case cover screw:**  
**2.5 N • m (0.25 kgf • m, 1.8 ft • lb)**  
**LOCTITE® 572**



### JET PUMP UNIT

#### Impeller inspection

1. Remove:
  - Battery  
Refer to "BATTERY" section.
2. View impeller condition through intake grate:
  - Impeller ①
  - Intake grate ②  
Wear/Damage → Replace.  
Scratch/Nick → File/Grind.
3. Remove:
  - Clean-out cap ① by pressing Release Bottom ④ and lift the cap out of the Port.
4. Measure:
  - Impeller clearance ③ ④ ⑤  
Out of specification → Replace.



**Measure at all three points with feeler gauge.**

**Impeller clearance limit:  
0.024 in (0.6mm)**

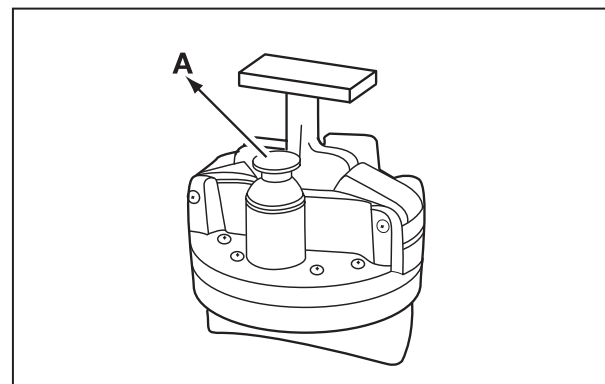
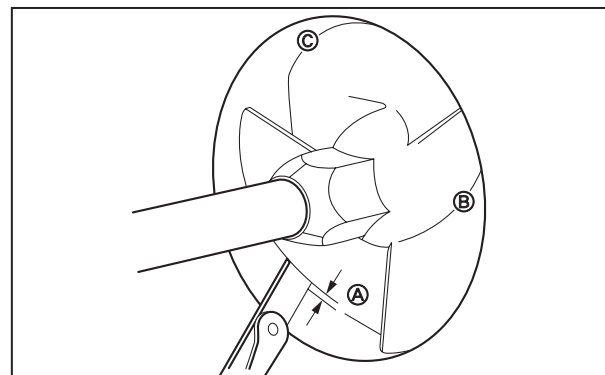
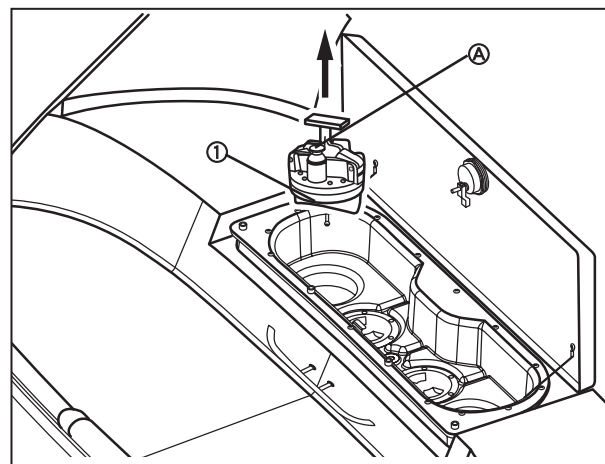
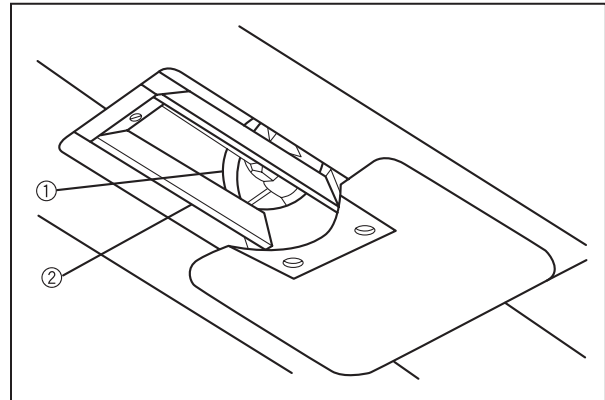
5. Install:
  - Clean-out cap

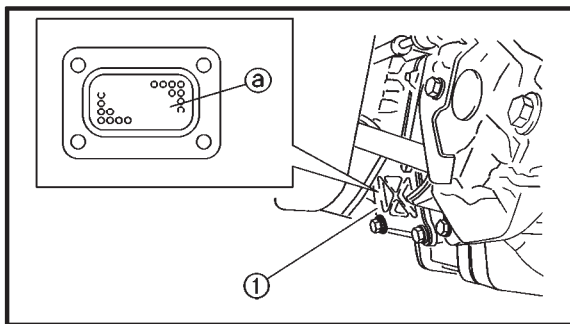
#### NOTE:

- Align the grooved recess on the clean-out cap with the projection in the clean-out opening.
- Holding the cap by the "T" handle, insert into the opening until fully seated.
- Firmly press the "T" handle till the cap locks in place.
- Firmly pull up on the "T" handle to verify the cap has locked securely in place.

#### CAUTION:

Be sure the cap is properly positioned and locked in place. Otherwise, the cap could loosen and be forced out of the access ports by water pressure, causing loss of performance and possible damage.



**Water inlet strainer inspection**

## 1. Inspect:

- Water inlet strainer  
Contaminants → Clean.  
Cracks/damage → Replace.

**Inspection steps:**

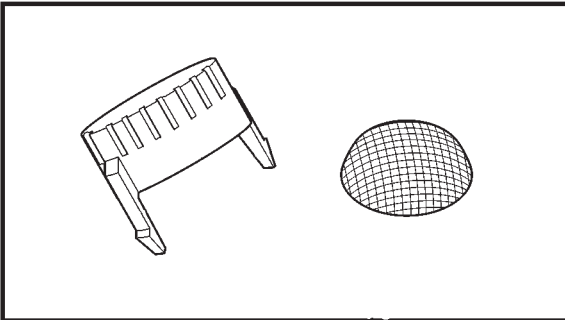
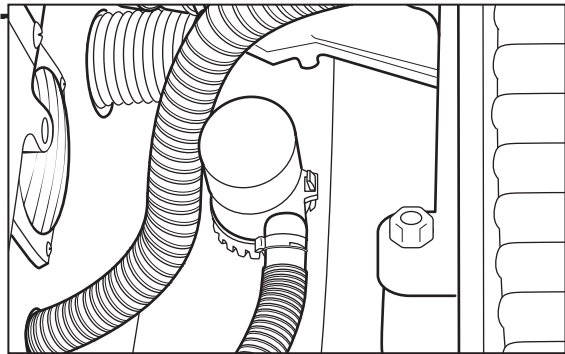
- Remove the ride plate.  
Refer to "INTAKE GRATE AND INTAKE DUCT" in Chapter 6.
- Remove the rubber plate.  
Refer to "JET PUMP UNIT" in Chapter 6.
- Remove the water inlet cover ①.
- Inspect the water inlet strainer mesh ②.
- Install the water inlet cover.
- Install the rubber plate.  
Refer to "JET PUMP UNIT" in Chapter 6.
- Install the ride plate.  
Refer to "INTAKE GRATE AND INTAKE DUCT" in Chapter 6.

**BILGE PUMP**

1. Remove inspection cover in pump clean-out tray.
2. Inspect:
  - Bilge strainer  
Contaminants → Clean.  
Cracks/damage → Replace.

**Inspection Steps:**

- Install the coupling cover.



### Electric bilge pump strainer inspection

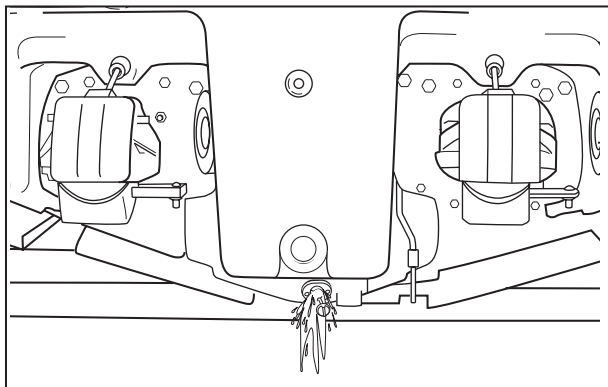
#### 1. Inspect:

- Cap
- Strainer

Contaminants → Clean.

#### Inspection steps:

- Remove the band ①.
- Remove the cap ② and strainer ③.
- Inspect the cap and strainer.
- Install the strainer and cap.
- Install the band.



## GENERAL

### Drain plug inspection

1. Inspect:
  - Drain plug  
Crack/Damage → Replace.
  - O-Ring  
Crack/Wear → Replace.
  - Screw threads  
Dirt/Sand → Clean.

### Greasing points

1. Apply:
  - Throttle cable inner wire
  - Shift control cable
  - Cable joint
  - Steering cable



**Recommended Grease:**  
**Water resistant grease**

#### NOTE:

Remove the cable joint and apply a small amount of grease to the following parts.

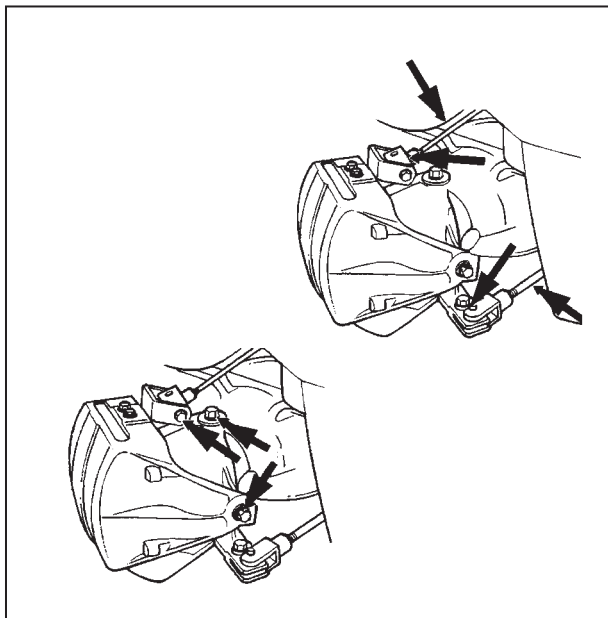
- Nozzle pivot shaft collar
- Bearing housing

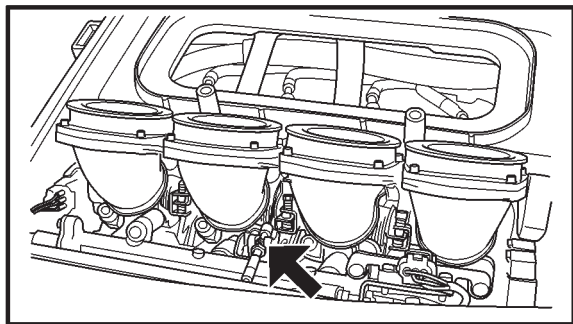


**Recommended Grease:**  
**Water resistant grease**

#### NOTE:

- Fill in the bearing housing with water resistant grease from a nipple.
- Fill the grease slowly and carefully, as it can damage the hose and the joints.
- Refer to the "MAINTENANCE INTERVAL CHART" section.





### Lubrication points

1. Lubricate:
  - Throttle cable (throttle body end)



**Recommended lubricant:**  
**Yamaha marine grease,**  
**Yamaha grease A**  
**(Water resistant grease)**

### NOTE:

Before lubricating the QSTS control cables, remove the QSTS cable housing cover. Spray the rust inhibitor into the outer cables, and apply grease to the inner cables.

2. Lubricate:
  - Nozzle pivot shaft
  - Steering cable (nozzle end)
  - QSTS cable (nozzle end)



**Recommended grease:**  
**Yamaha marine grease,**  
**Yamaha grease A**  
**(Water resistant grease)**

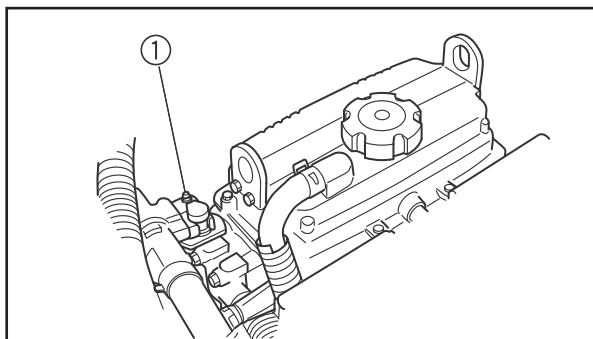
3. Lubricate:
  - Steering cable
  - Steering cable joint
  - Shift cable
  - Shift cable joint

### NOTE:

Disconnect the joints and apply a small amount of grease.



**Recommended grease:**  
**Yamaha marine grease,**  
**Yamaha grease A**  
**(Water resistant grease)**



## 4. Fill:

- Intermediate housing



**Recommended grease:**  
Yamaha marine grease,  
Yamaha grease A  
(Water resistant grease)

**Grease quantity:**

**Initial 10 hours:**

33.0–35.0 cm<sup>3</sup> (1.11–1.18 oz)

**Every 100 hours or 12 months:**

6.0–8.0 cm<sup>3</sup> (0.20–0.27 oz)

**NOTE:**

Fill the intermediate housing with the recommended grease through the grease nipple ①.

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## CHAPTER 4

### FUEL SYSTEM

#### FUEL TANK AND FUEL PUMP MODULE

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REMOVAL AND INSTALLATION CHART .....	4-1
SERVICE POINTS .....	4-4
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Fuel pump module removal .....	4-4
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Fuel hose inspection .....	4-4
Fuel pump filter inspection .....	4-5
Fuel pump module installation .....	4-5
Fuel hose connect .....	4-5

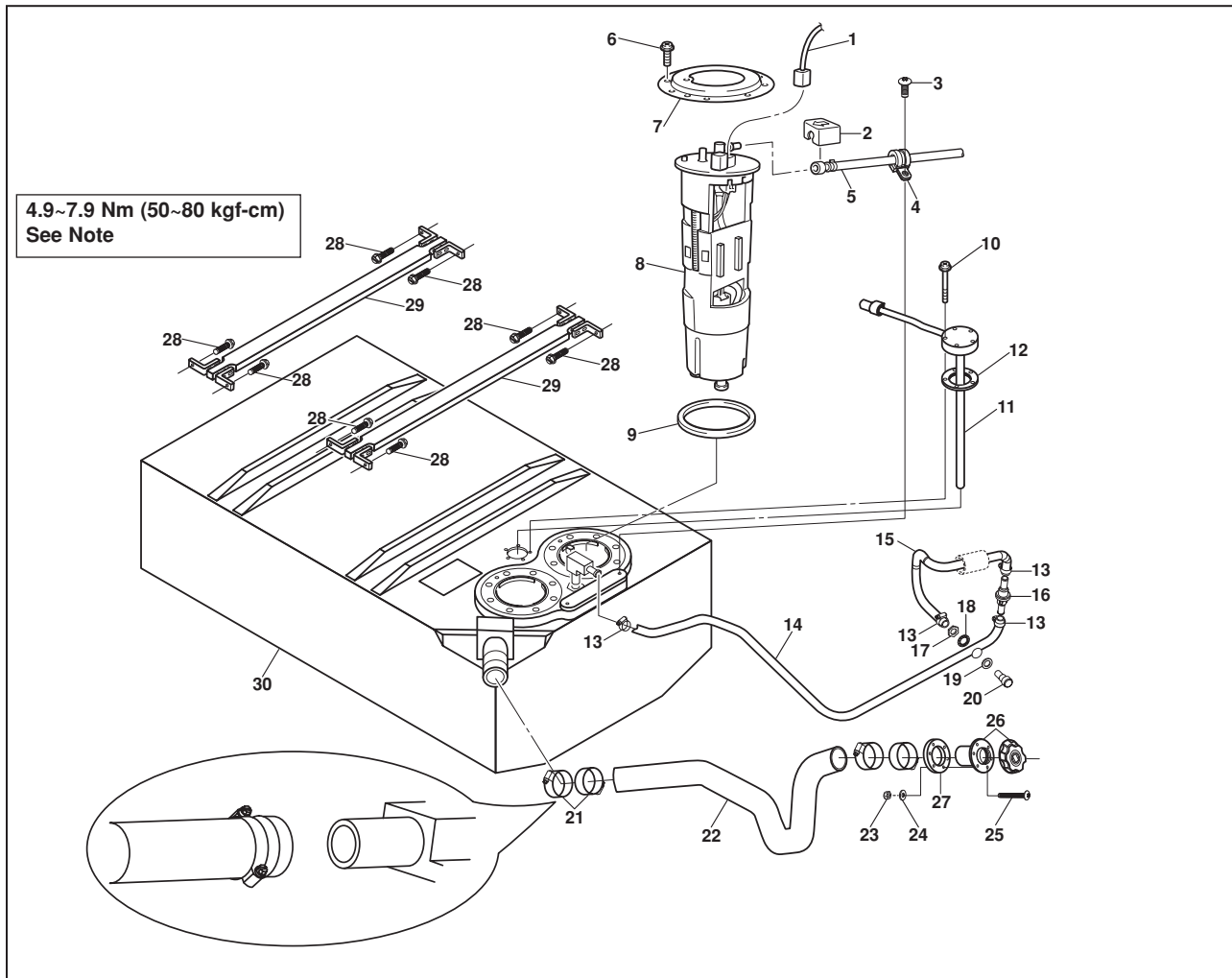
#### FUEL INJECTION SYSTEM

EXPLODED DIAGRAM .....	4-6
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Fuel pressure measurement .....	4-25





## FUEL TANK AND FUEL PUMP MODULE EXPLODED DIAGRAM



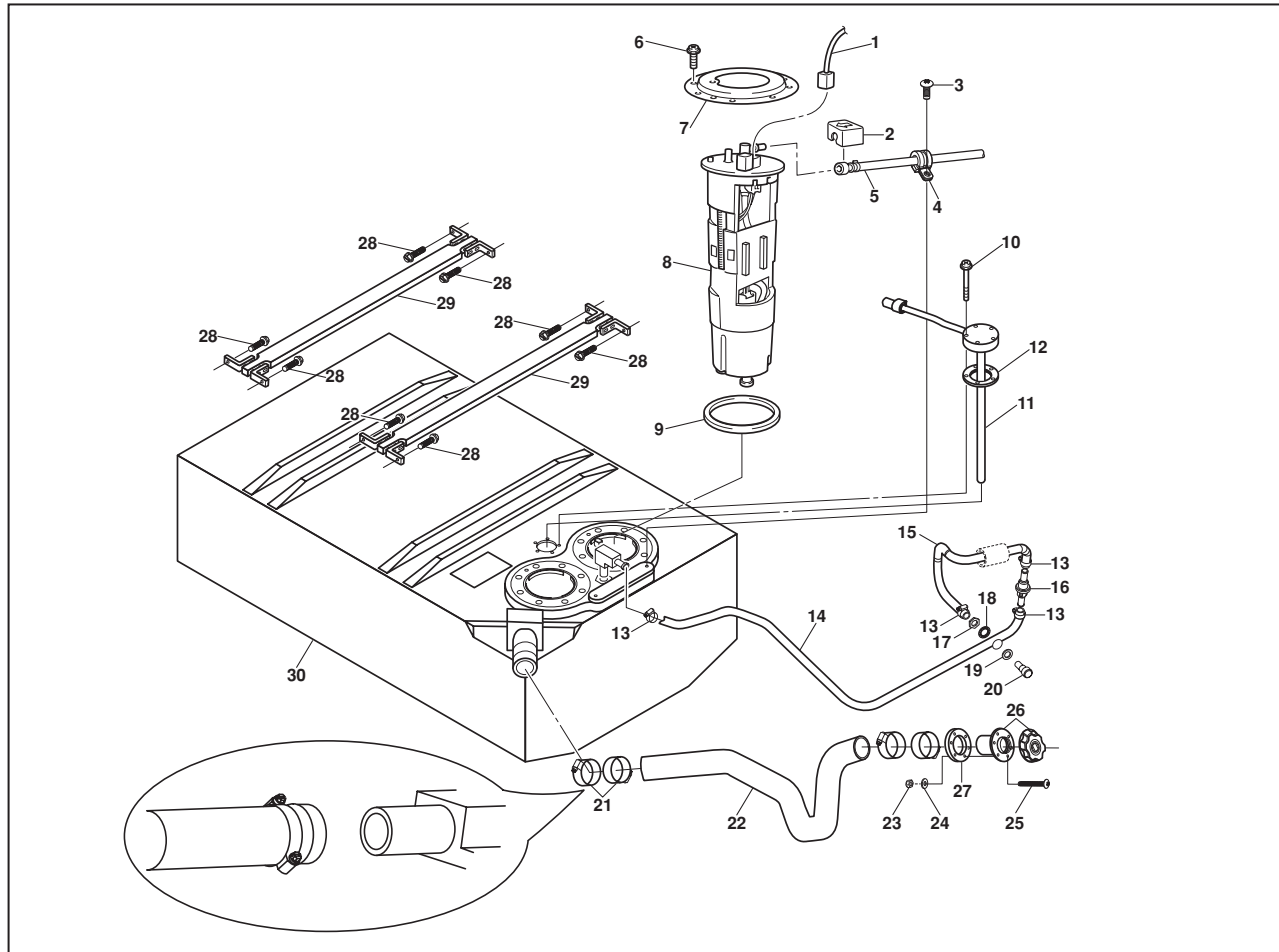
## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
<b>FUEL TANK PUMP MODULE</b>			Follow the "Step" order for removal.
1	Connector, harness	2	<b>NOTE:</b> Apply Loctite, torque in 2 steps see page 4-4 Pump Module Removal, 4-5 Installation
2	Cover	2	
3	Screw, Machine	2	
4	Clamp	2	
5	Fuel hose	2	
6	Screw	16	
7	Plate	2	Apply Loctite, 2.9 Nm (30 kgf-cm)
8	Fuel Pump Assembly	2	
9	Seal	2	
10	Screw	5	



## FUEL TANK AND FUEL PUMP MODULE (Cont'd.)

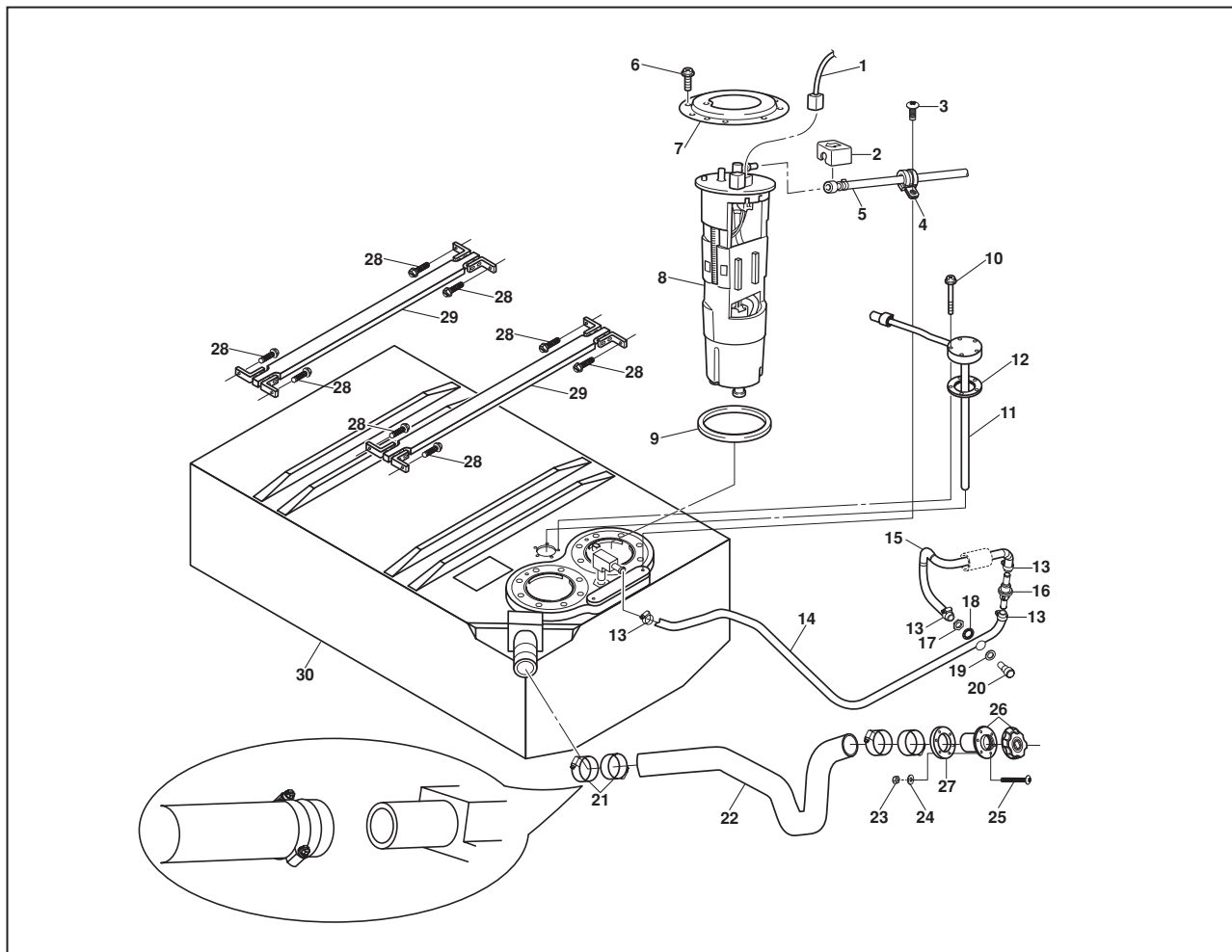
## EXPLODED DIAGRAM



Step	Procedure / Part Name	Q'ty	Service Points
11	Fuel Level Sender	1	4.2 Nm (0.42 kgf-m, 3.0 ft-lbs) See detail on clamp installation
12	Gasket	1	
13	Clamp	4	
14	Hose, Vent	1	
15	Hose, Vent	1	
16	Valve, Check	1	
17	Nut	1	
18	Washer, Star	1	
19	Washer	1	
20	Vent, Fuel	1	
21	Clamp	4	
22	Hose, Fuel Filler	1	
23	Nut, #8-32 Nylon Lock	6	
24	Washer, #8 Flat	6	
25	Screw, #8-32	6	



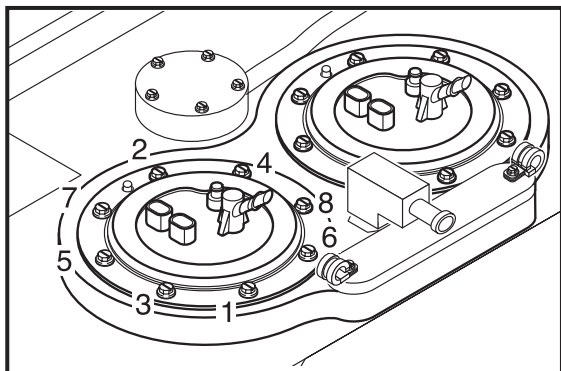
## FUEL TANK AND FUEL PUMP MODULE (Cont'd.) EXPLODED DIAGRAM



Step	Procedure / Part Name	Q'ty	Service Points
26	Filler Cap Assembly	1	<b>Note:</b> Deck must be cut at outline to access fuel tank for removal 4.9~7.9 Nm (50~80 kgf-cm)
27	Gasket	1	
<b>FUEL TANK</b>			
28	Screw, Machine 1/4" - 20 x 1"	8	
29	Fix, Fuel Tank	2	
30	Fuel Tank Assembly	1	Reverse the removal steps for installation.

**SERVICE POINTS****Fuel hose disconnection**

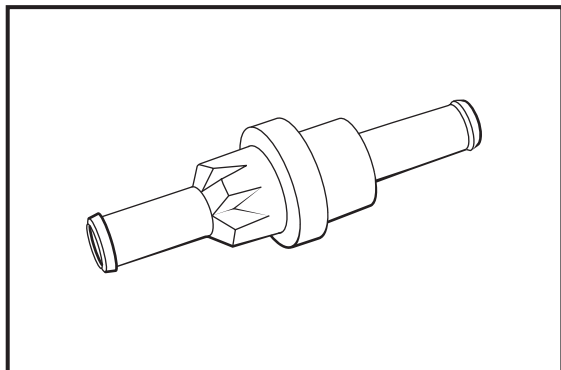
1. Disconnect:
  - Fuel hoseRefer to “FUEL INJECTION SYSTEM.”

**Fuel pump module removal**

1. Remove:
  - Screws
  - Retainer

**NOTE:** \_\_\_\_\_  
Loosen the screws in the sequence shown.

2. Remove:
  - Fuel pump module ①

**Check valve inspection**

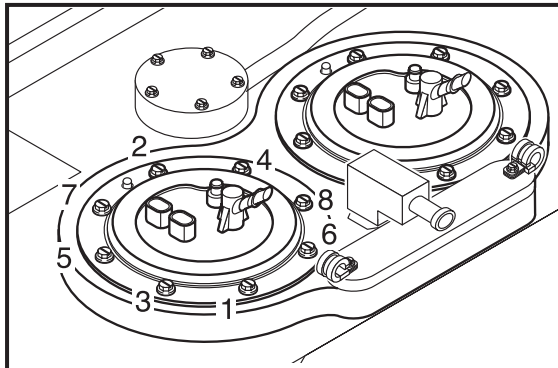
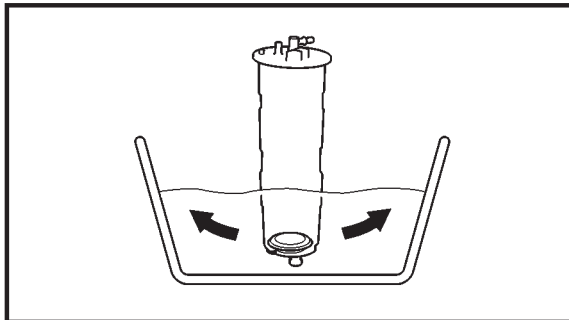
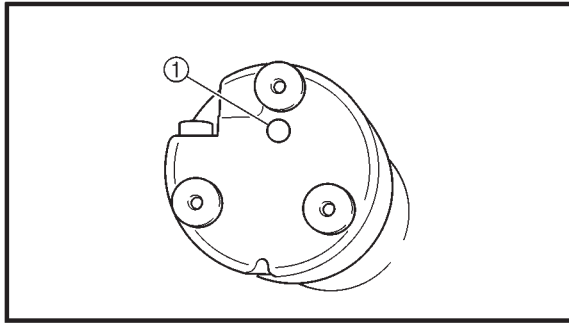
1. Check:
  - Check valveFaulty → Replace.

**Fuel tank inspection**

1. Inspect:
  - Fuel tankCracks/damage → Replace.

**Fuel hose inspection**

Refer to “FUEL INJECTION SYSTEM”.

**Fuel pump filter inspection****1. Inspect:**

- Fuel pump filter ①  
Clog/contaminants → Wash the fuel pump filter in kerosene or gasoline.

**Fuel pump module installation****1. Tighten:**

- Screws

**Fuel pump module nut:****1st:**

4.9 Nm (0.49 kgf-m)

**2nd:**

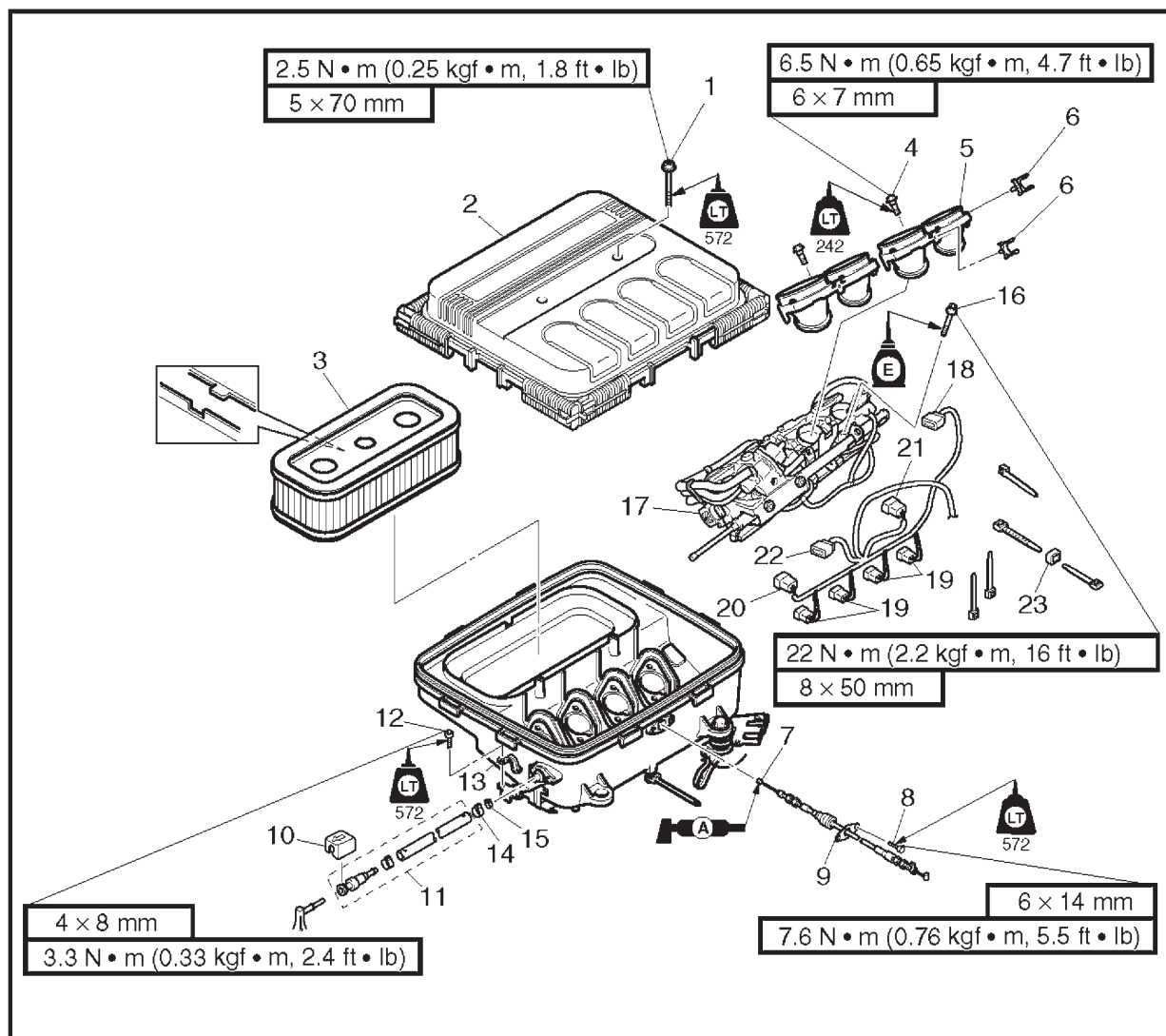
7.9 Nm (0.8 kgf-m)

**NOTE:** \_\_\_\_\_Tighten the nuts in the sequence shown.  
\_\_\_\_\_**Fuel hose connect**

Refer to "FUEL INJECTION SYSTEM."



## FUEL INJECTION SYSTEM EXPLODED DIAGRAM

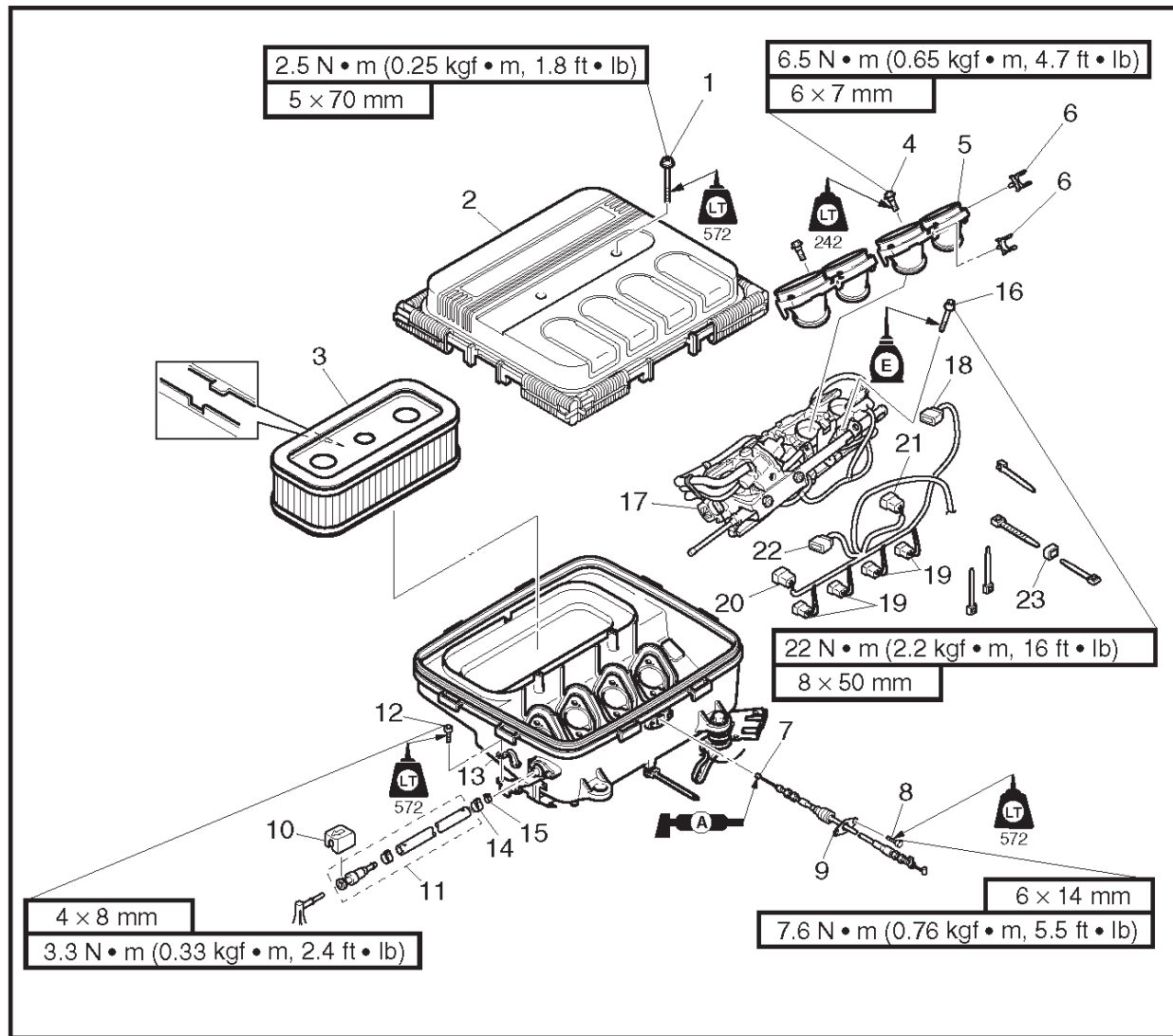


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>THROTTLE BODIES REMOVAL</b>		Follow the left "Step" for removal.
1	Screw	2	
2	Air filter case cover	1	
3	Air filter	1	
4	Bolt	4	
5	Ribbon sub assembly	2	
6	Holder	2	
7	Throttle cable	1	
8	Bolt	2	
9	Throttle cable holder	1	
10	Cover	1	



## FUEL INJECTION SYSTEM (Cont'd.) EXPLODED DIAGRAM

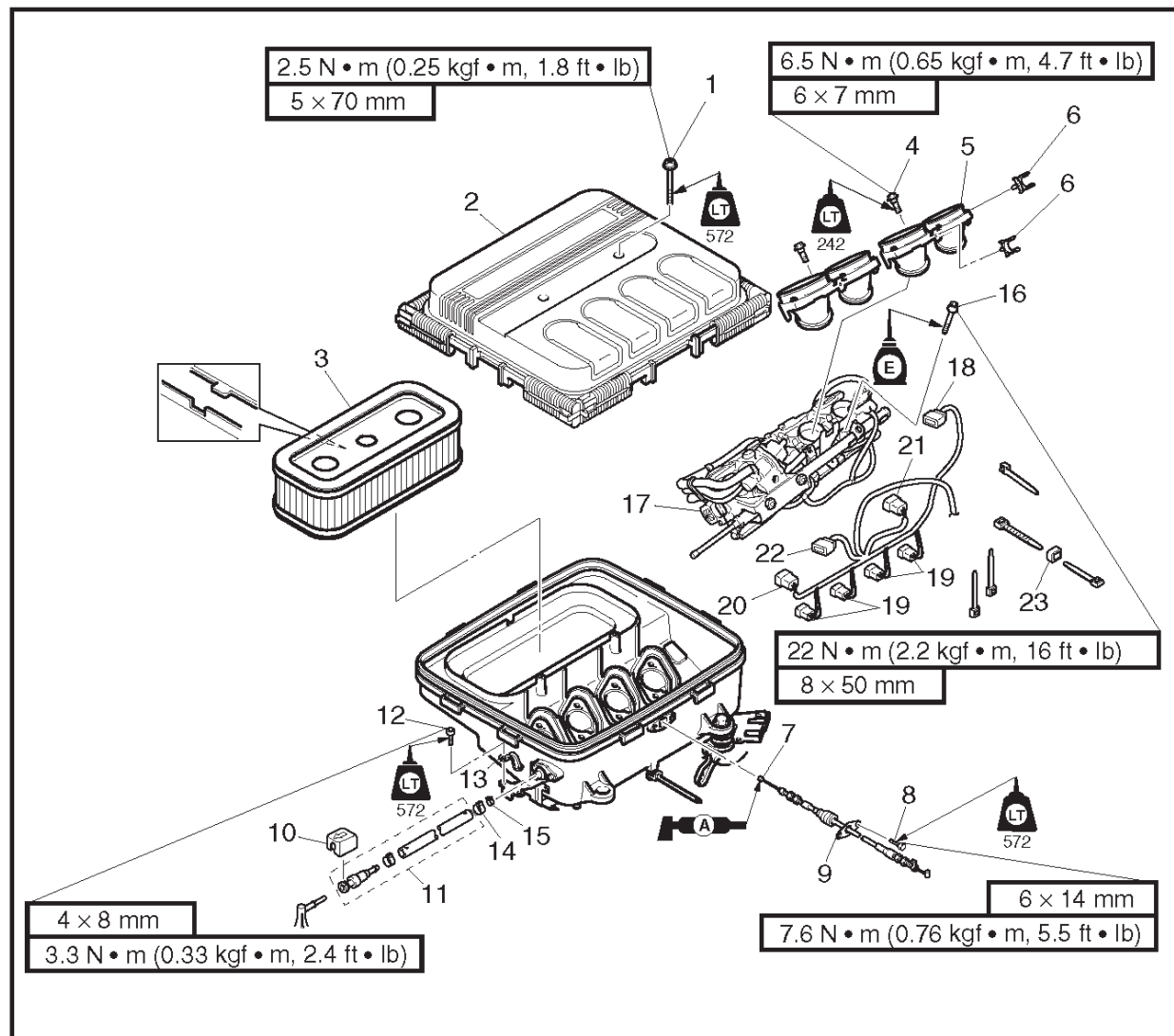


Step	Procedure/Part name	Q'ty	Service points
11	Fuel hose	1	<b>Not reusable</b>
12	Bolt	2	
13	Fuel hose holder	1	
14	Clamp	1	
15	Clamp	1	
16	Bolt	8	
17	Throttle bodies	1	
18	Sensor assembly coupler	1	
19	Fuel injector coupler	4	
20	Throttle position sensor coupler	1	



## FUEL INJECTION SYSTEM (Cont'd.)

## EXPLODED DIAGRAM

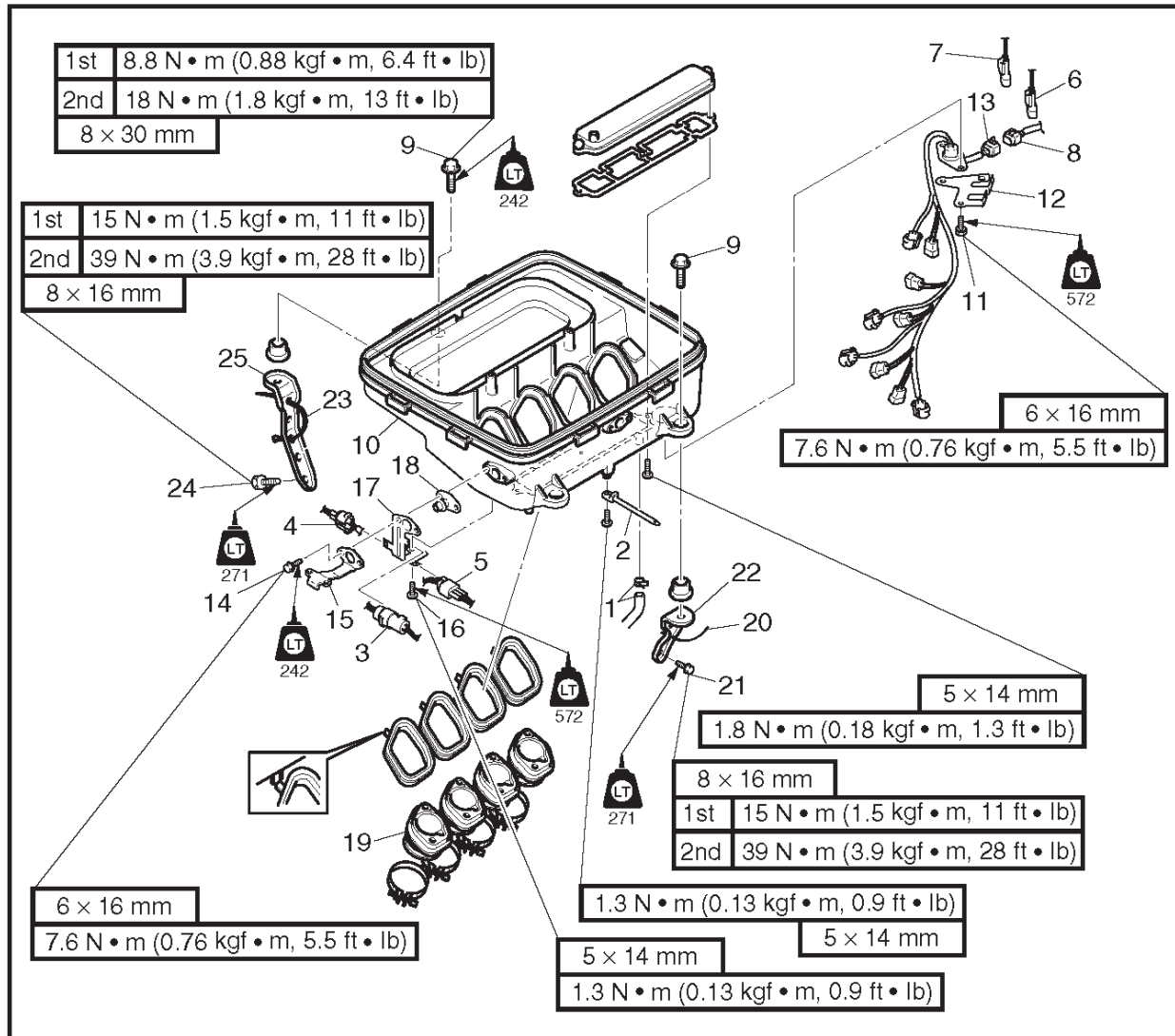


Step	Procedure/Part name	Q'ty	Service points
21	Joint connector	1	Reverse the removal steps for installation.
22	Bypass valve motor coupler	1	
23	Ring	1	





# FUEL INJECTION SYSTEM (Cont'd.) EXPLODED DIAGRAM

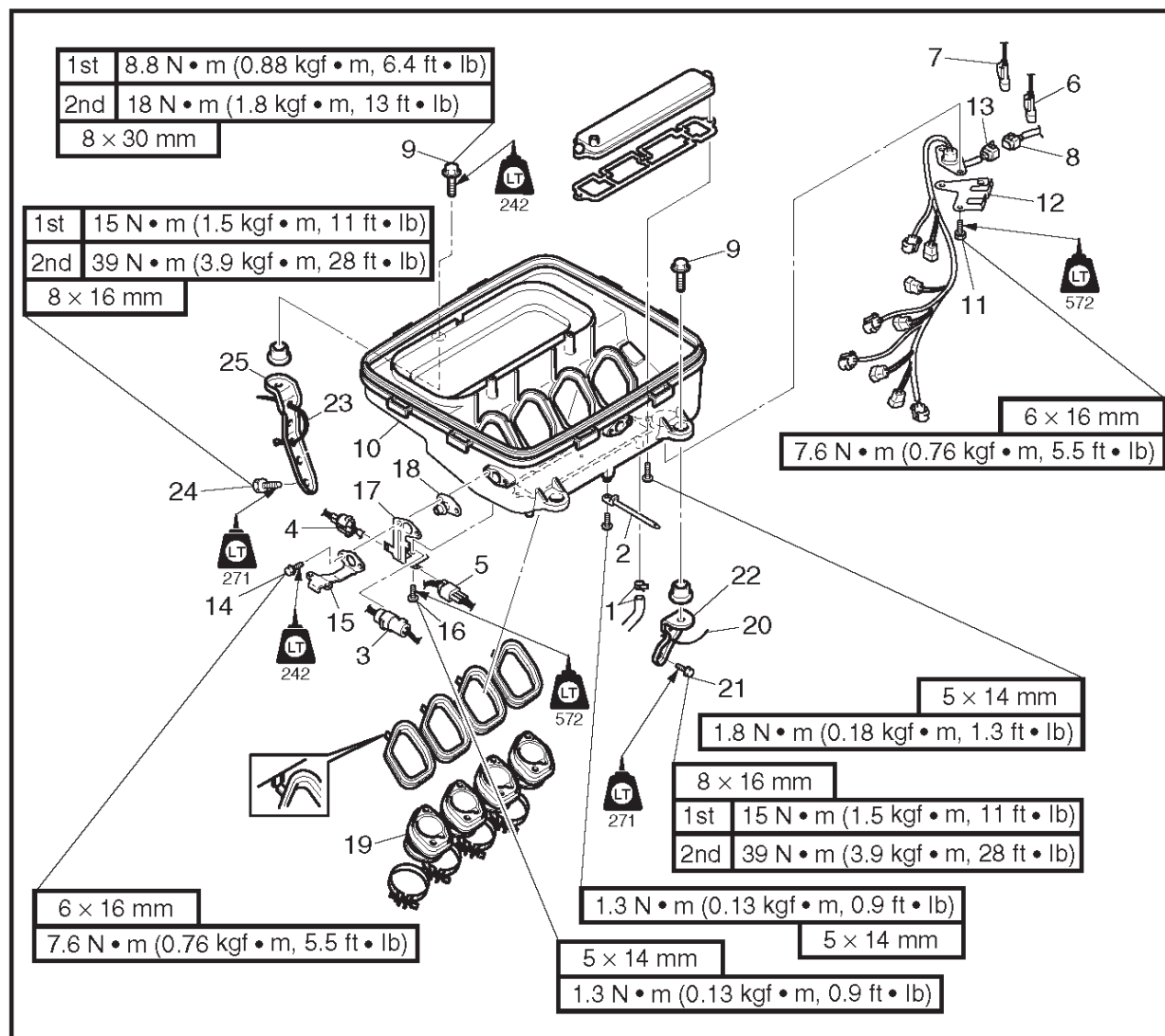


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>AIR FILTER CASE REMOVAL</b>		Follow the left "Step" for removal.
	Throttle bodies		
1	Clamp/breather hose	1/1	
2	Band	1	Unfasten the wiring harness.
3	Lighting coil coupler	1	From wiring harness bracket 2
4	Thermoswitch coupler (engine)	1	From wiring harness bracket 2
5	Pickup coil coupler	1	From wiring harness bracket 2
6	Thermoswitch coupler (exhaust)	1	From wiring harness bracket 1
7	Cam position sensor coupler	1	From wiring harness bracket 1



## FUEL INJECTION SYSTEM (Cont'd.) EXPLODED DIAGRAM

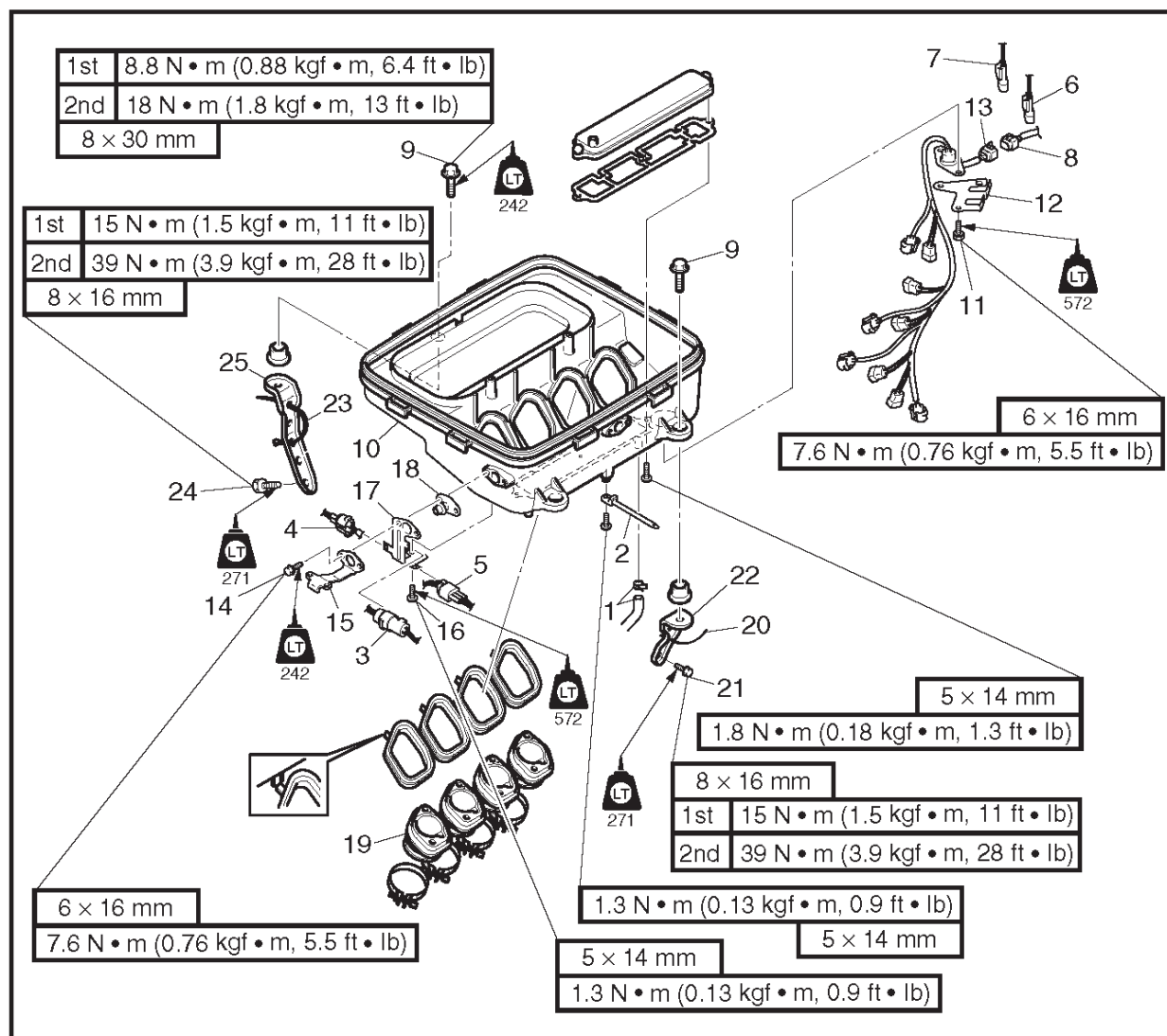


Step	Procedure/Part name	Q'ty	Service points
8	Wiring harness coupler	1	
9	Bolt	3	
10	Air filter case	1	
11	Bolt	2	
12	Wiring harness bracket 1	1	
13	Sub wiring harness	1	
14	Bolt	2	
15	Fuel hose bracket	1	
16	Screw	1	
17	Wiring harness bracket 2	1	



## FUEL INJECTION SYSTEM (Cont'd.)

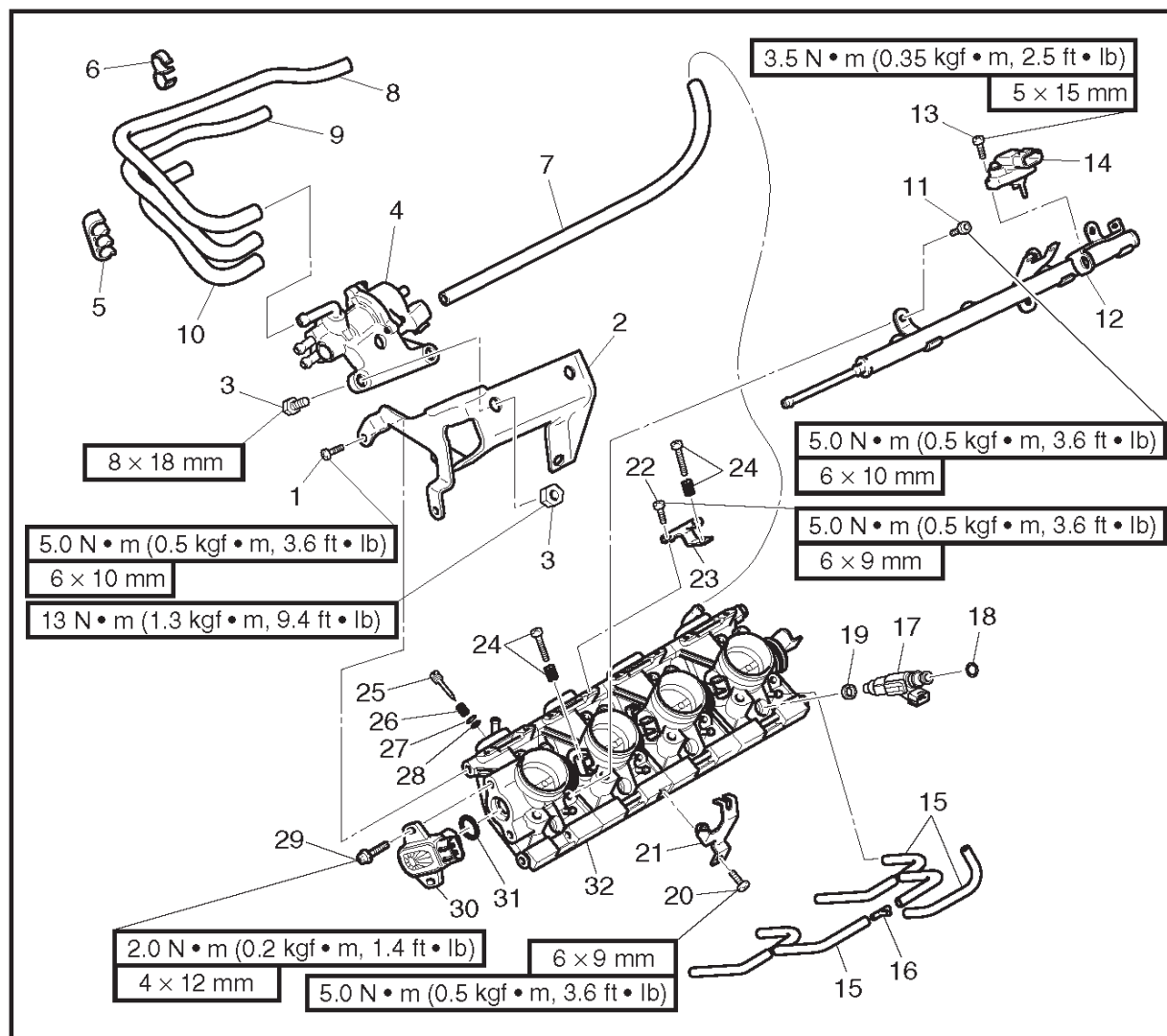
## EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
18	Grommet	1	
19	Throttle body joint	4	
20	Band	2	
21	Bolt	2	
22	Air filter case stay 1	2	
23	Band	1	
24	Bolt	1	
25	Air filter case stay 2	1	
			Reverse the removal steps for installation.



## FUEL INJECTION SYSTEM (Cont'd.) EXPLODED DIAGRAM

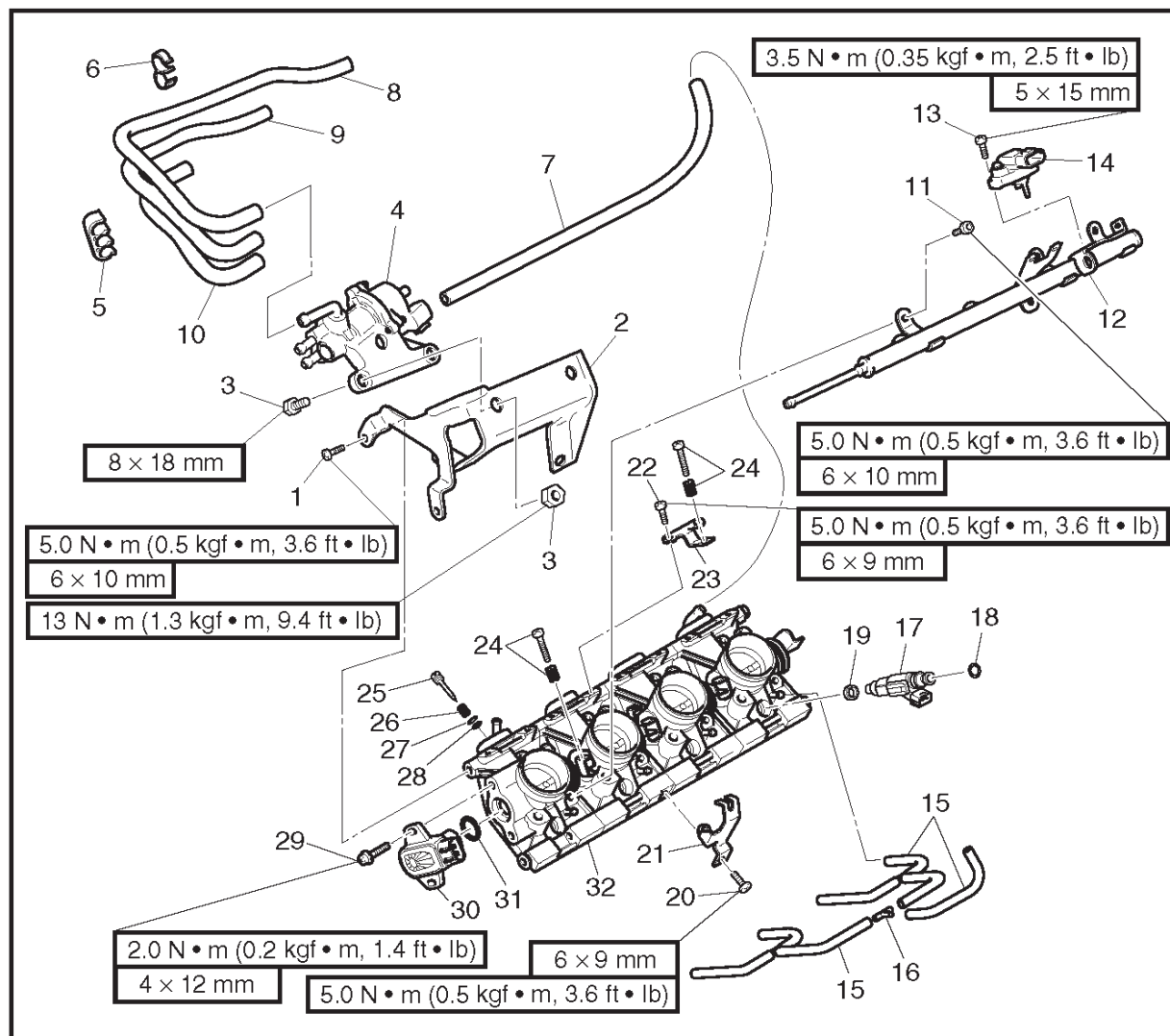


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>THROTTLE BODY DISASSEMBLY</b>		Follow the left "Step" for disassembly.
1	Screw	3	
2	Bracket	1	
3	Bolt/nut	2/2	
4	Bypass valve motor	1	
5	Holder	1	
6	Holder	1	
7	Hose #4	1	
8	Hose #3	1	
9	Hose #2	1	
10	Hose #1	1	



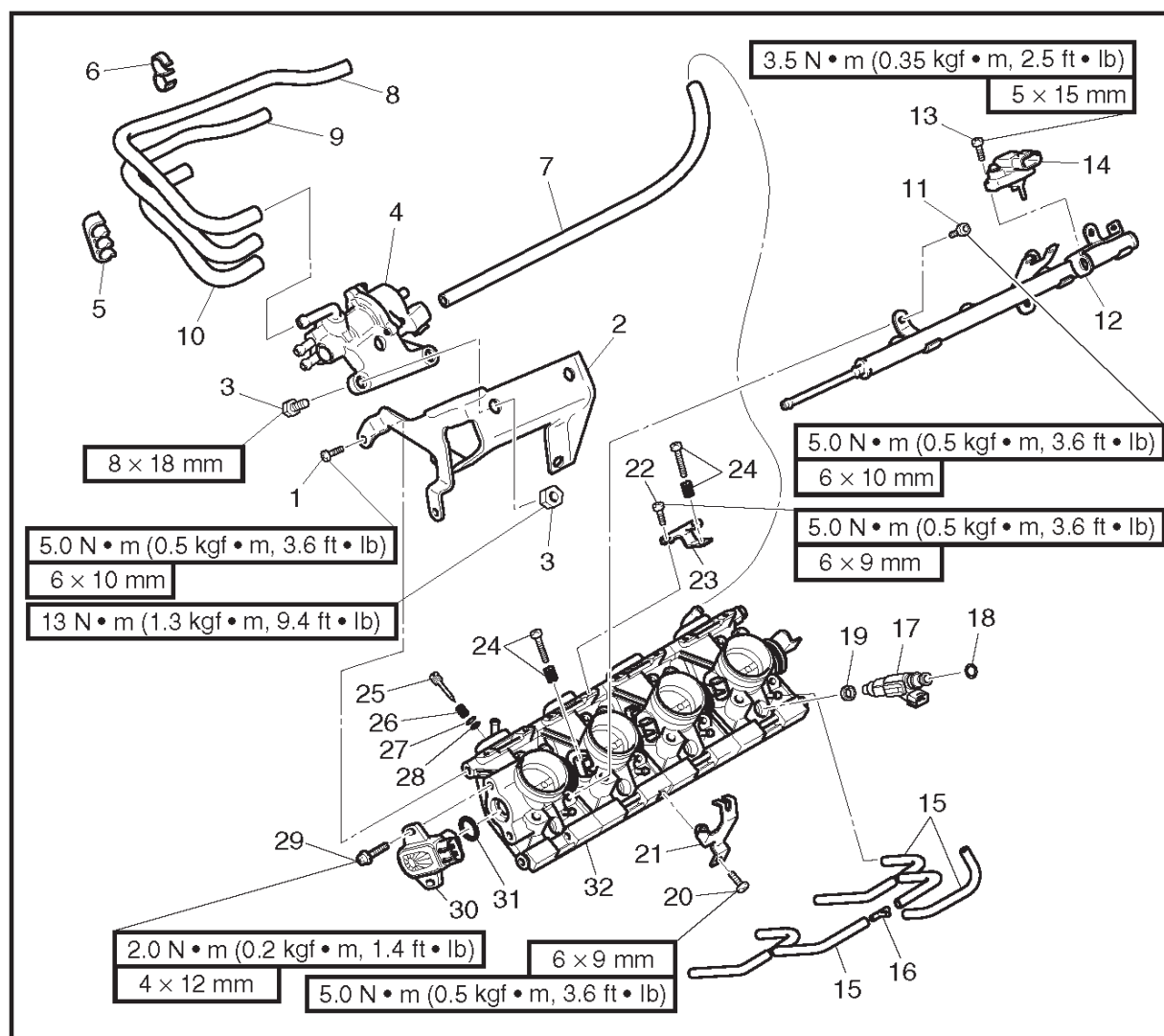
# FUEL INJECTION SYSTEM (Cont'd.) EXPLODED DIAGRAM



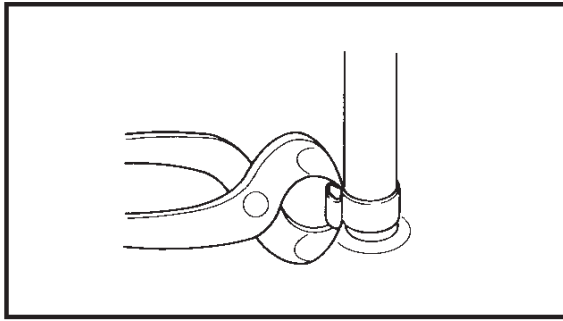
Step	Procedure/Part name	Q'ty	Service points
11	Bolt	4	<div>Not reusable</div> <div>Not reusable</div>
12	Fuel rail	1	
13	Screw	2	
14	Sensor assembly	1	
15	Intake vacuum hose	3	
16	Joint	1	
17	Fuel injector	4	
18	O-ring	4	
19	Grommet	4	
20	Screw	2	
21	Throttle stop guide	1	
22	Screw	2	



## FUEL INJECTION SYSTEM (Cont'd.) EXPLODED DIAGRAM



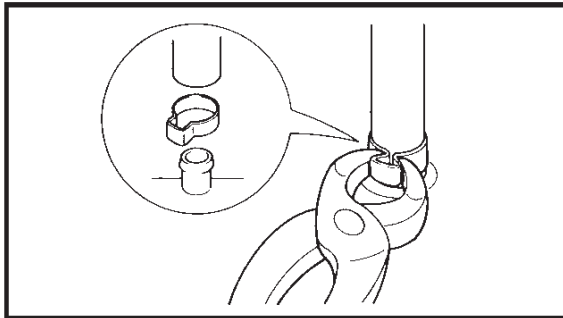
Step	Procedure/Part name	Q'ty	Service points
23	Throttle stop screw bracket	1	<div>Not reusable</div> <div>Not reusable</div> <div>Reverse the disassembly steps for assembly.</div>
24	Screw/spring	4/4	
25	Bypass air screw	4	
26	Spring	4	
27	Washer	4	
28	O-ring	4	
29	Screw	2	
30	Throttle position sensor	1	
31	O-ring	1	
32	Throttle bodies	1	

**SERVICE POINTS****Hose clamps removal**

1. Remove:
  - Hose clamps

**CAUTION:**

If the hose clamps are removed without cutting the joint first, the fuel hose will be damaged.

**Hose clamps installation**

1. Install:
  - Hose clamps

**⚠ WARNING**

Do not reuse the hose clamps, always replace them with new ones.

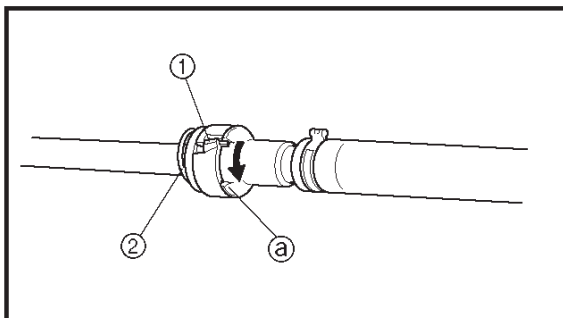
**NOTE:**

Crimp the hose clamps properly to securely fasten them.

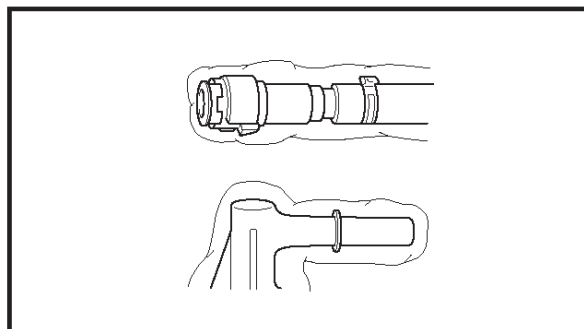
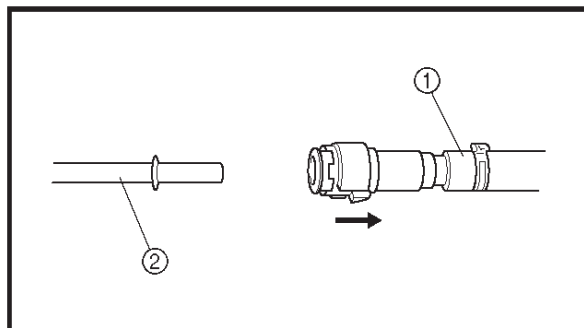
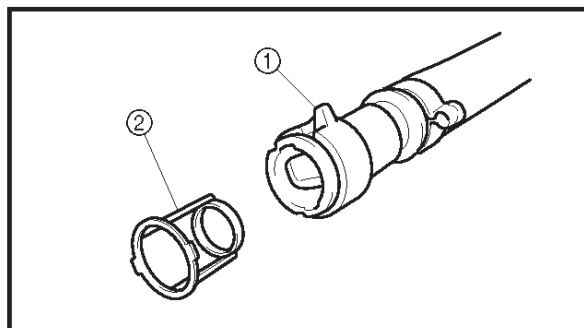
**Fuel hose disconnection****⚠ WARNING**

Before disconnecting the hose, remove the fuel tank filler cap to reduce any pressure inside the fuel tank, and then disconnect the battery negative lead to cut off the electric current to the electrical systems.

1. Wrap the quick connector with a cloth, and then rotate the quick connector tab ① to the stopper position ②.

**⚠ WARNING**

If the quick connector is removed suddenly, pressurized fuel could spray out. To gradually release the fuel pressure, be sure to remove the quick connector slowly.

**CAUTION:**

- Do not rotate the quick connector tab ① past the stopper position ②, otherwise it could be damaged.
- When the fuel hoses are disconnected, quickly remove the retainer ② from the quick connector, otherwise the retainer could be lost.

2. Disconnect the fuel hose ① from the fuel pipe ② directly.

**⚠ WARNING**

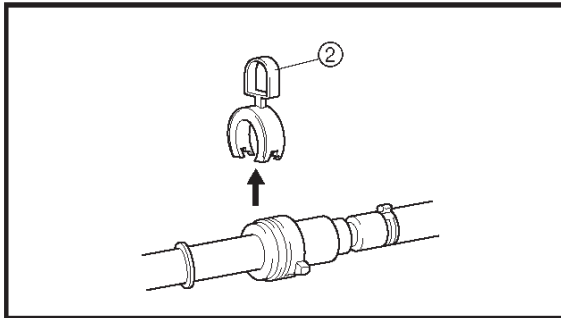
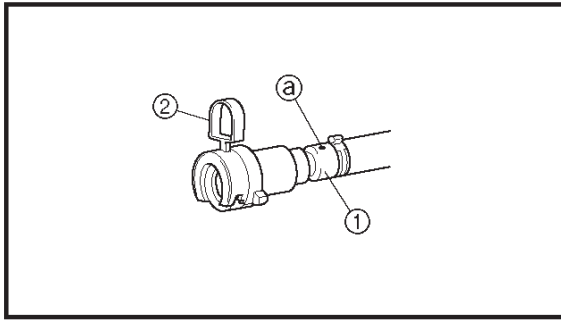
Always reduce the fuel pressure in the fuel line before servicing the line or the fuel pipe. If the fuel pressure is not released, pressurized fuel could spray out.

3. Cover the quick connector and fuel pipe with a plastic bag to prevent damage and to protect them from dirt.

**Fuel line inspection**

1. Inspect:
  - Fuel hose  
Damage/cracks → Replace.
  - O-rings (quick connector)  
Damage/cracks → Replace the quick connector.
  - Fuel pipe  
Damage/cracks → Replace the fuel pump.





### Fuel hose installation (replacing with new fuel hose)

#### 1. Install:

- Fuel hose ①

#### NOTE:

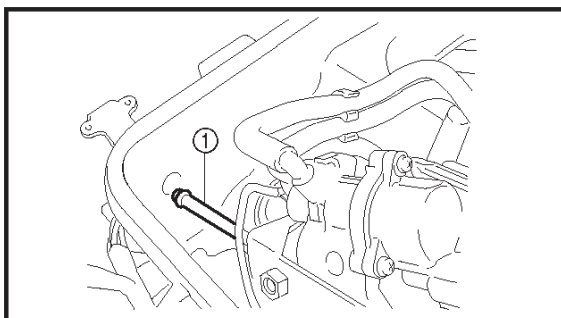
- To install the fuel hose, be sure to align the white mark ③ of the fuel hose with the checker tab ② of the quick connector.
- When replacing the fuel hose with a new one, a checker tab ② that has half engagement prevention is attached to the quick connector of the hose. If the quick connector is completely installed to the fuel pipe, it is removable.

### Fuel hose connection

1. Apply a thin coat of engine oil to the contact surfaces of the fuel pipe.
2. Insert the quick connector into the fuel pipe until you hear a "click."
3. To check the connection of the quick connector, push and pull on the quick connector several times until there is free play of 2–3 mm (0.08–0.12 in).

#### NOTE:

If free is not obtained, disconnect the fuel hose and check the O-ring for damage and that it is properly installed.



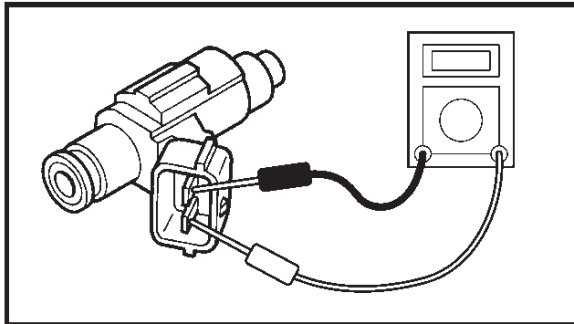
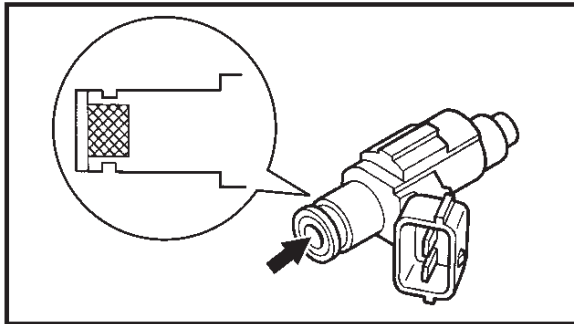
### Throttle body removal

#### 1. Remove:

- Throttle body

#### CAUTION:

Do not bend the fuel pipe ①.



### Fuel injector inspection

#### CAUTION:

The throttle bodies should not be disassembled unnecessarily.

#### 1. Check:

- Injector  
Dirt/residue → Clean.  
Damage → Replace.

#### 2. Measure:

- Fuel injectors resistance  
Out of specification → Replace.



**Digital multimeter:**

**YU-34899-A**

**Digital circuit tester:**

**90890-03174**



**Fuel injector resistance:**

**(reference data)**

**11.5–12.5  $\Omega$  at 20 °C (68 °F)**

3. Check the operation of the fuel injector using the “Stationary Test” of the Yamaha Diagnostic System.

### Throttle body inspection

#### 1. Check:

- Throttle body  
Cracks/damage → Replace the throttle bodies.

#### 2. Check:

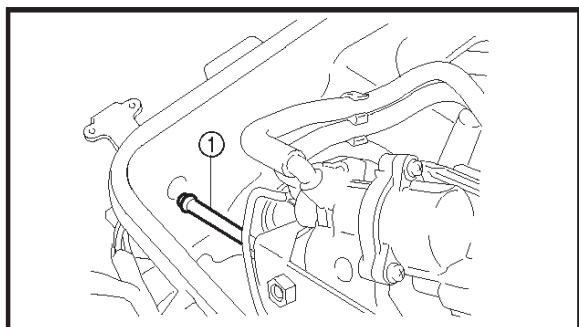
- Fuel passages  
Obstruction → Clean.

#### Checking steps:

- Wash the throttle body in a petroleum based solvent.  
Do not use any caustic carburetor cleaning solution.
- Blow out all of passages with compressed air.

**Bypass valve motor inspection**

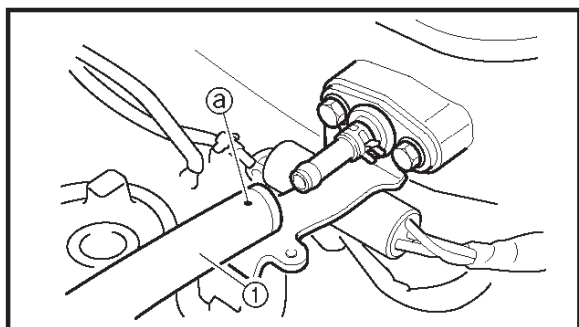
1. Inspect:
  - Hoses  
Damage/cracks → Replace.
2. Check:
  - Check the bypass valve motor operation using the Yamaha Diagnostic System.

**Throttle body installation**

1. Install:
  - Throttle body

**CAUTION:**

Do not bend the fuel pipe ①.

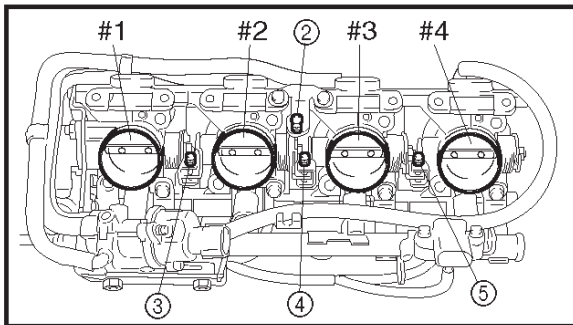
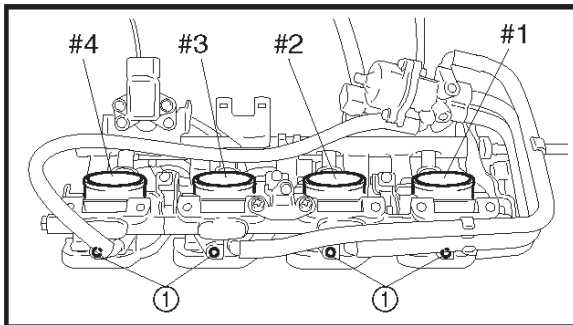


2. Install:
  - Fuel hose ① (throttle body side)
  - Clamp

**NOTE:**

Install the fuel hose with the white mark ① facing up.

3. Adjust:
  - Throttle lever free play  
Refer to “CONTROL SYSTEM” in Chapter 3.



### Throttle bodies synchronization

1. Remove:
  - Throttle bodies
  - Air filter case
2. Adjust:
  - Throttle bodies synchronization

#### Adjustment steps:

##### NOTE:

The bypass air screws ① should not be adjusted. However, if it is necessary to remove the bypass air screw, be sure to note the number of times the screw is turned from its set position. When installing the screw, be sure to tighten the screw the same number of turns as noted at removal. If the number of turns is not known, turn the screw approximately 2.5 times counter-clockwise from the fully closed position.

##### CAUTION:

**Do not start the engine when removing the fuel hose. Fuel can spurt out when the fuel pump is operated.**

- a. Loosen the throttle stop screw ② and synchronizing screws #1 ③, #2 ④, and #3 ⑤ until released from the levers.

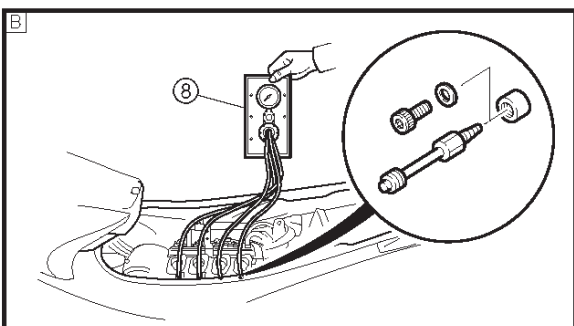
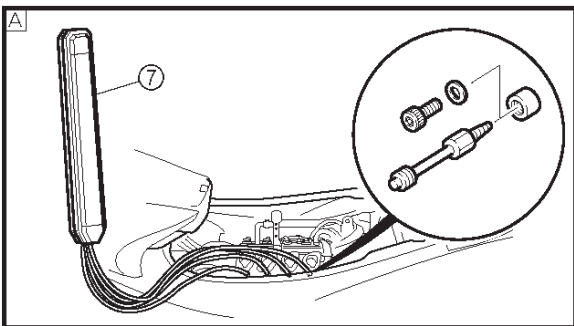
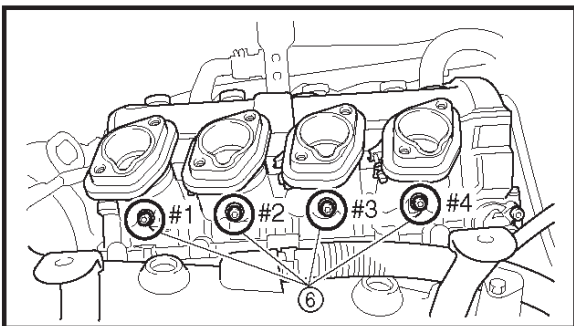
##### NOTE:

- Only butterfly valve #2 should be fully closed and the other valves should be halfway closed.
- Check the valve for light leaks with a flashlight. If there are no light leaks, the valve is fully closed.

- b. Turn synchronizing screw #2 ④ clockwise approximately 7 times until it starts to contact the lever.

##### NOTE:

- Butterfly valves #2 and #3 should be fully closed. Butterfly valve #2 opens if the screw is turned more than 7 times.
- If butterfly valves #2 and #3 are not fully closed, close the valves by adjusting synchronizing screw #2 ④.



- c. Turn synchronizing screw #1 ③ clockwise approximately 7 times until it starts to contact the lever.

**NOTE:**

- Butterfly valve #1 should be fully closed. Butterfly valves #2 and #3 open if the screw is turned more than 7 times.
- If butterfly valves #1, #2, and #3 are not fully closed, close the valves by adjusting synchronizing screw #1 ③.

- d. Turn synchronizing screw #3 ⑤ clockwise approximately 7 times until it starts to contact the lever.

**NOTE:**

- Butterfly valve #4 should be fully closed. Butterfly valves #1, #2, and #3 open if the screw is turned more than 7 times.
- If all butterfly valves are not fully closed, close the valves by adjusting synchronizing screw #3 ⑤.

- e. Check that all butterfly valves are fully closed and that they open simultaneously.

**NOTE:**

If all butterfly valves are not fully closed, close the valves by repeating steps a–d.

- f. Turn the throttle stop screw ② clockwise approximately 1.5 times until it starts to contact the throttle lever.

- g. Remove the plugs ⑥.

- h. Install the carburetor synchronizer ⑦ or vacuum gauge ⑧.

**A** For USA and Canada

**B** For worldwide

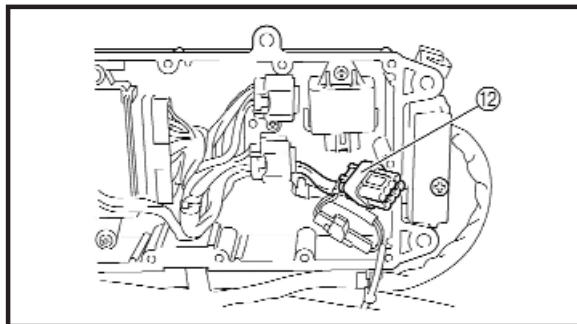
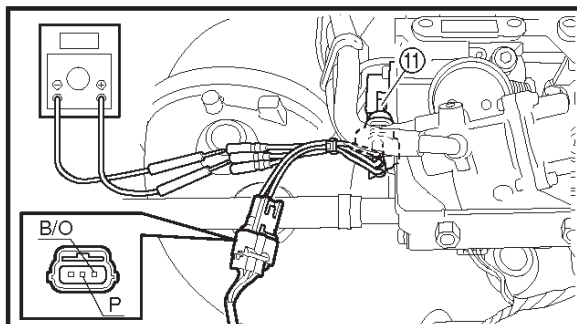
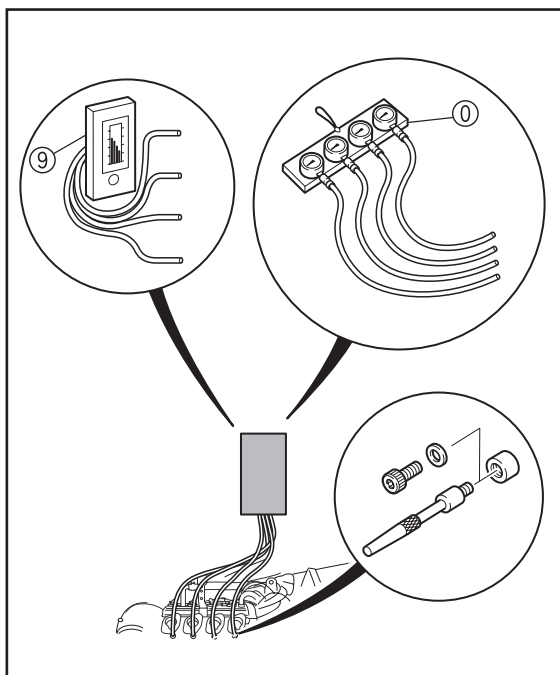


**Carburetor synchronizer:**

**YU-08030**

**Vacuum gauge:**

**90890-03094**

**NOTE:**

For best results, use a vacuum gauge (commercially obtainable), like ⑨ or ⑩ shown in the illustration, that has four adapters.

- i. Install the throttle bodies.

**NOTE:**

Adjust the throttle body synchronization with the air filter case uninstalled.

- j. Connect the fuel hose and clamp.  
k. Connect the Yamaha Diagnostic System.  
l. Remove the sub wiring harness from the air filter case, and then connect it to the throttle bodies and main wiring harness.  
m. Connect the test harness (3 pin) to the throttle position sensor ⑪.



**Test harness (3 pins):**

**YB-06793**

**Test harness SMHW099-3**

**(3 pins):**

**90890-06793**

- n. To start the ECM normally, start the Yamaha Diagnostic System.

**CAUTION:**

If the Yamaha Diagnostic System and ECM are started, fuel can spurt out. Be sure to connect the fuel hoses and throttle bodies when adjusting the throttle position sensor.

**NOTE:**

Use the test connector ⑫ to start the ECM normally only if the Yamaha Diagnostic System is not available.

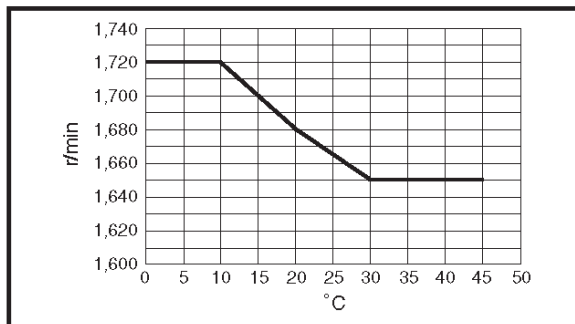


**Test connector:**

**YW-06862**

**Test connector FMY-8:**

**90890-06862**



- o. Measure the throttle position sensor output voltage (DC). Adjust the throttle position sensor ⑪ position if out of specification.



**Throttle position sensor output voltage:**

**Pink (P) – Black/orange (B/O)**  
 $0.756 \pm 0.016 \text{ V}$

- NOTE:**
- To decrease the output voltage, turn the throttle position sensor clockwise.
  - Slightly tighten the throttle position screw.

- p. Start the engine and let it run at trolling speed for 20 minutes.

- NOTE:**
- Warm the engine up in the water.
  - While checking the engine temperature with the Yamaha Diagnostic System, warm the engine up until the engine temperature is 50 °C (122 °F).

- q. Adjust the throttle stop screw until trolling speed is within specification.



**Trolling speed:**

Season	Temperature	Specified engine speed
Summer	30 °C (86 °F) or more	1,650 r/min
Winter	10 °C (50 °F) or less	1,720 r/min
Spring/ Fall	20 °C (68 °F)	1,680 r/min

- r. Adjust each cylinder to the cylinder differences shown in the table using synchronizing screws ③–⑤ and using cylinder #2 as the standard.



**Vacuum pressure at trolling speed:**

Cylinder	Cylinder difference	Example
#1	$-18 \pm 10$ mmHg ( $-2.45 \pm 1.33$ kPa, $-0.8 \pm 0.4$ inHg)	$-230 \pm 10$ mmHg ( $-30.68 \pm 1.33$ kPa, $-9.1 \pm 0.4$ inHg)
#2	Standard*0	$-212$ mmHg ( $-28.23$ kPa, $-8.3$ inHg)
#3	$-11 \pm 10$ mmHg ( $-1.53 \pm 1.33$ kPa, $-0.5 \pm 0.4$ inHg)	$-223 \pm 10$ mmHg ( $-29.76 \pm 1.33$ kPa, $-8.8 \pm 0.4$ inHg)
#4	$+1.0 \pm 10$ mmHg ( $+0.04 \pm 1.33$ kPa, $0 \pm 0.4$ inHg)	$-211 \pm 10$ mmHg ( $-28.19 \pm 1.33$ kPa, $-8.3 \pm 0.4$ inHg)

Standard\*: When setting the specified engine speed, the value is zero.

**NOTE:**

Always maintain the specified trolling speed when making this adjustment.

- s. Measure the throttle position sensor output voltage. Adjust the throttle position sensor position if out of specification.



**Throttle position sensor output voltage:**

Pink (P) – Black/orange (B/O)  
 $0.756 \pm 0.016$  V

3. Remove:

- Throttle bodies

4. Remove:

- Carburetor synchronizer or vacuum gauge

5. Install:

- Plugs



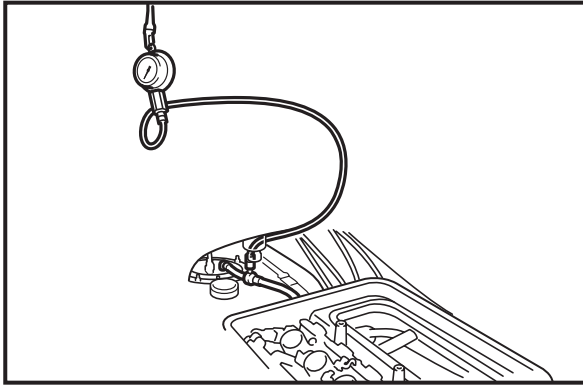
**Plug (vacuum pressure):**

$10$  N • m ( $1.0$  kgf • m,  $7.2$  ft • lb)

6. Install:

- Air filter case
- Throttle bodies



**Fuel pressure measurement**

## 1. Disconnect:

- Fuel hose  
Refer to “Fuel hose disconnection”.

## 2. Install:

- Fuel pressure gauge adapter ①
- Fuel pressure gauge ②



**Fuel pressure gauge adapter:**  
YW-06842/90890-06842

**Fuel pressure gauge:**  
YB-06766/90890-06786

**NOTE:**

To connect the fuel pressure gauge adapter, follow the procedures for connecting a fuel hose. (Refer to “Fuel hose connection”.)

3. Start the engine and allow it to warm up for several minutes.

## 4. Measure:

- Fuel pressure  
Out of specification → Replace the fuel pump module.



**Fuel pressure:**  
310–330 kPa  
(3.1–3.3 kgf/cm<sup>2</sup>, 45–47 psi)

## 5. Remove:

- Fuel pressure gauge
- Fuel pressure gauge adapter

**NOTE:**

To disconnect the fuel pressure gauge adapter, follow the procedures for disconnecting a fuel hose. (Refer to “Fuel hose disconnection”.)

## 6. Connect:

- Fuel hose  
Refer to “Fuel hose connection”.

---

## CHAPTER 5

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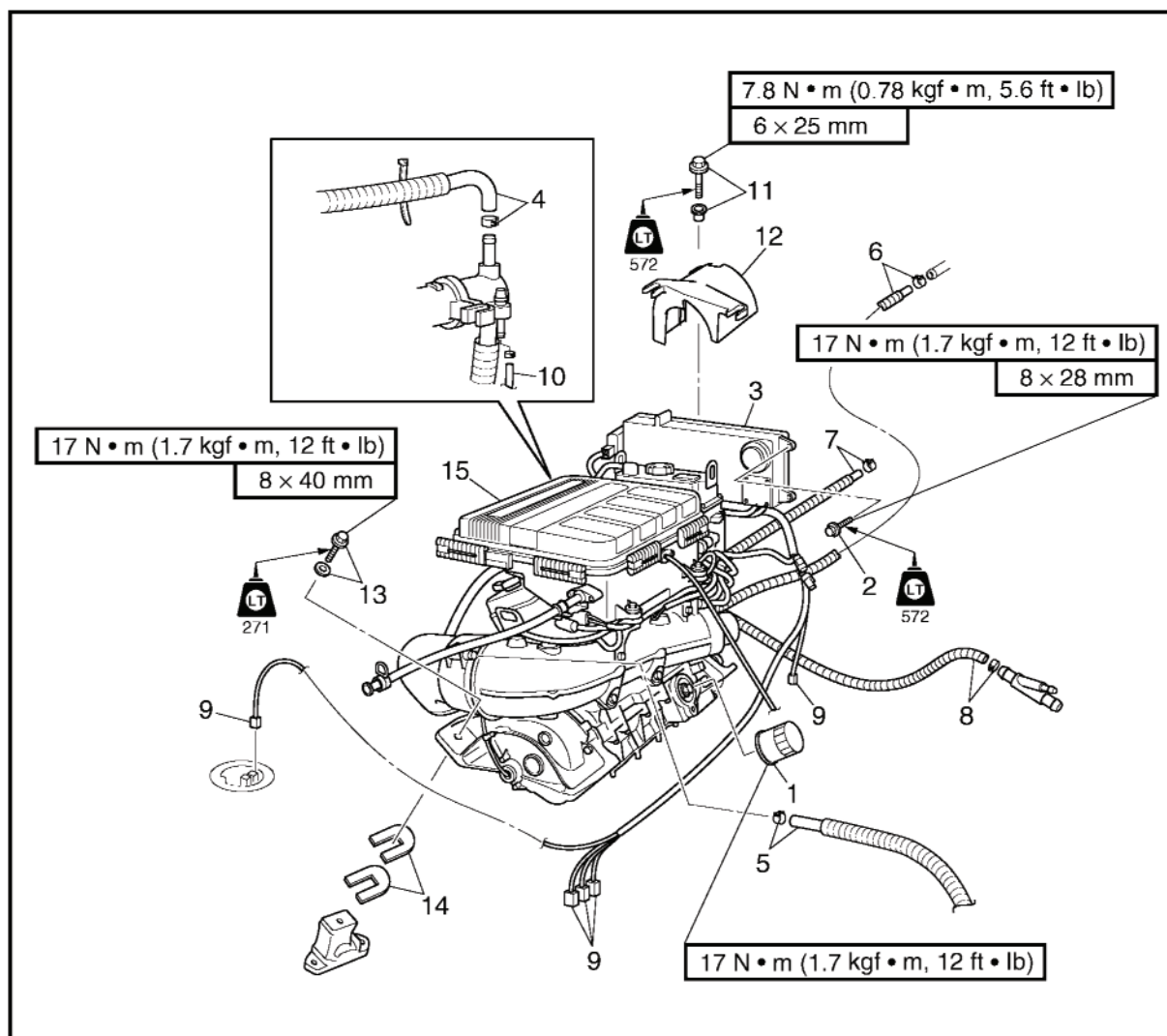
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## ENGINE UNIT EXPLODED DIAGRAM



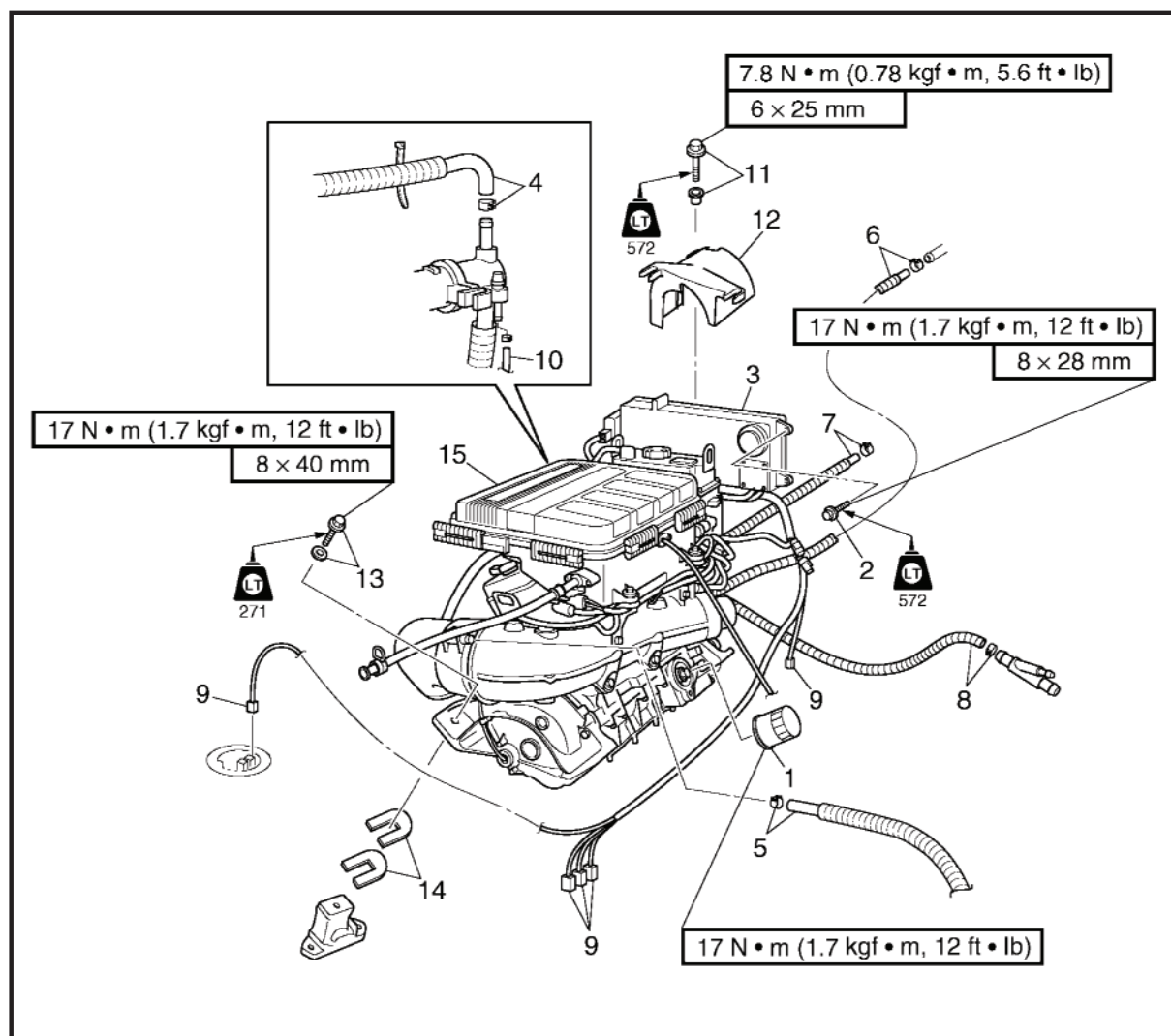
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>ENGINE UNIT REMOVAL</b>		Follow the left "Step" for removal.
	Engine oil		Drain.
	Service lid 1		Refer to "POWER UNIT" in Chapter 3.
	Battery negative and positive lead		Refer to "ENGINE HATCH" in Chapter 8.
	Throttle cable and fuel hose		Refer to "ELECTRICAL BOX AND IGNITION COIL BOX" in Chapter 7.
	Water lock and exhaust joint		Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
1	Oil filter	1	Refer to "EXHAUST SYSTEM" in Chapter 8.
2	Bolt	4	



## ENGINE UNIT

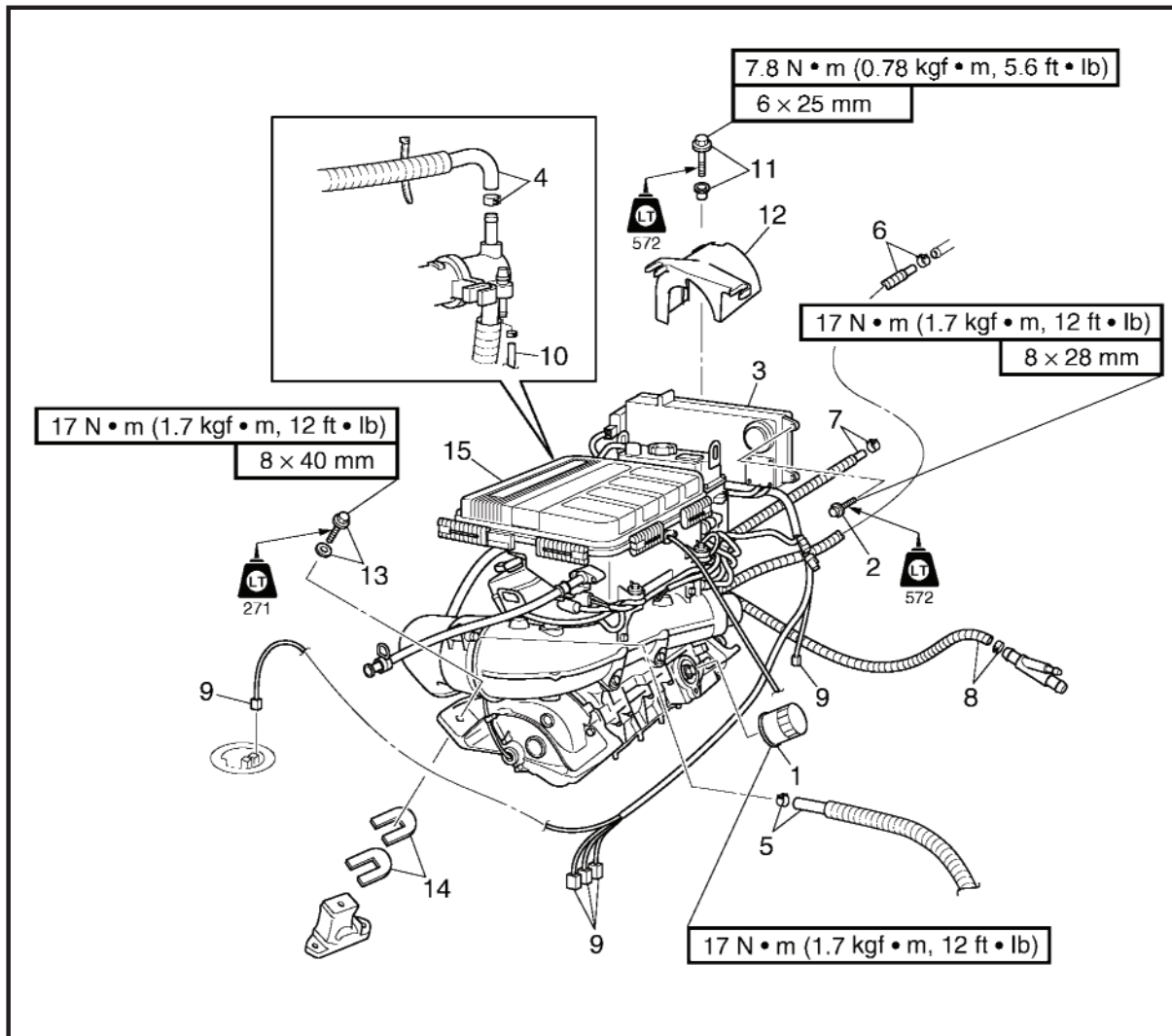
## EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
3	Electrical box	1	
4	Clamp/cooling water hose	1/1	Cooling water pilot outlet
5	Clamp/cooling water hose	1/1	Cooling water pilot outlet
6	Clamp/cooling water hose	1/1	Cooling water outlet
7	Clamp/cooling water hose	1/1	Cooling water outlet
8	Clamp/cooling water hose	1/1	Cooling water inlet
9	Coupler	5	
10	Grease hose	1	
11	Bolt/collar	1/1	
12	Coupling cover	1	



## EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
13	Bolt/washer	4/4	Reverse the removal steps for installation.
14	Shim	*	
15	Engine unit	1	

\*: As required.





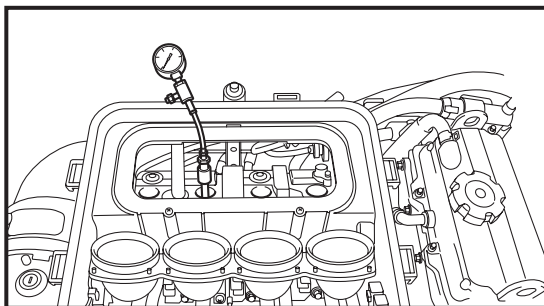
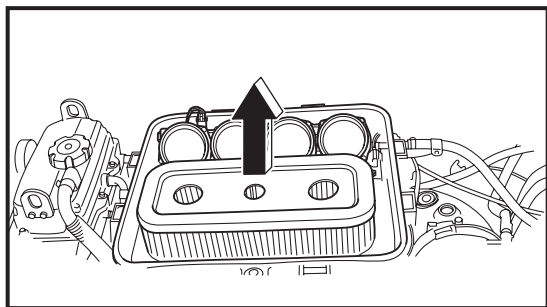
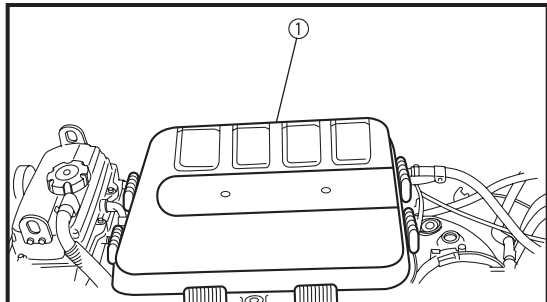
## SERVICE POINTS

### Compression pressure measurement

The following procedure applies to all of the cylinders.

#### NOTE:

Insufficient compression pressure will result in a loss of performance.



#### 1. Measure:

- Valve clearance  
Out of specification → Adjust.  
Refer to “POWER UNIT” in Chapter 3.

#### 2. Warm the engine up, and then put the watercraft in a horizontal position.

#### 3. Remove:

- Air filter case cover ①
- Air filter element

#### 4. Disconnect:

- Spark plug cap

#### 5. Remove:

- Spark plug

#### CAUTION:

Before removing the spark plugs, use compressed air to blow away any dirt accumulated in the spark plug wells to prevent it from falling into the cylinders.

#### 6. Install:

- Compression gauge extension ①
- Compression gauge ②



**Compression gauge extension:**  
90890-06582

**Compression gauge:**  
YU-33223-1/90890-03160



## 7. Measure:

- Compression pressure

Out of specification → Refer to steps (b) and (c).


**Minimum compression pressure (reference data):**

**1,080 kPa  
(10.8 kgf/cm<sup>2</sup>, 157 psi)**

**Measurement steps:**

- a. With the throttle wide open, crank the engine until the reading on the compression gauge stabilizes.

**! WARNING**

**To prevent sparking, ground all spark plug leads before cranking the engine.**

**NOTE:**

The difference in compression pressure between cylinders should not exceed 100 kPa (1 kgf/cm<sup>2</sup>, 14 psi).

- b. If the compression pressure is extremely high, check the cylinder head, valve surfaces and piston crown for carbon deposits.

Carbon deposits → Eliminate.

- c. If the compression pressure is below the minimum specification, squirt a few drops of oil into the cylinder and measure again.

Refer to the following table.

**Compression pressure  
(with oil applied into the cylinder)**

Reading	Diagnosis
Higher than without oil	Piston wear or damage → Repair.
Same as without oil	Piston ring(s), valves, cylinder head gasket or piston possibly defective → Repair.

## 8. Install:

- Spark plug

**Spark plug:**

**13 N • m (1.3 kgf • m, 9.4 ft • lb)**

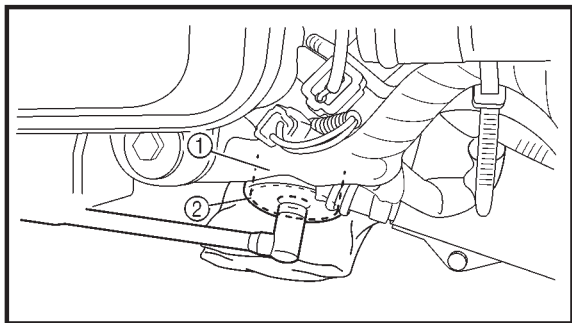


## 9. Install:

- Air filter element
- Air filter case cover



**Air filter case cover screw:**  
 2.5 N • m (0.25 kgf • m, 1.8 ft • lb)  
 LOCTITE® 572



## Oil filter removal and installation

## 1. Remove:

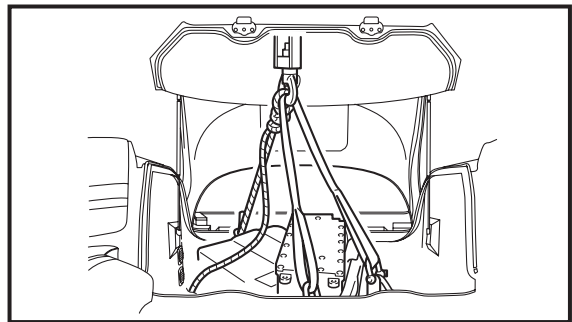
- Oil filter ①



**Oil filter wrench ②:**  
 YU-38411/90890-01426



**Oil filter:**  
 17 N • m (1.7 kgf • m, 12 ft • lb)

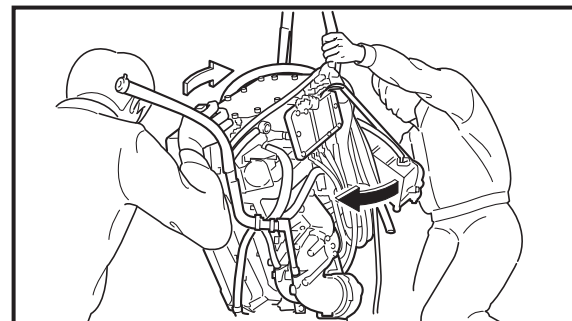
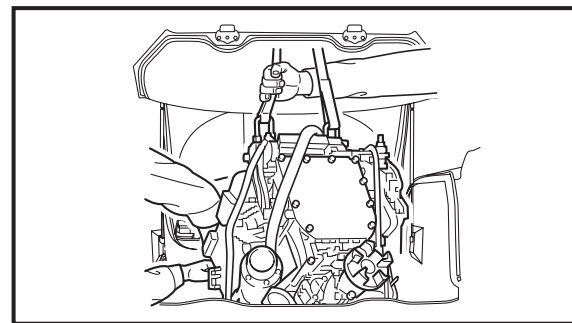
**NOTE:**

Install the oil filter with the same special tool that was used for removal.

## Engine unit removal

## 1. Remove:

- Engine unit



## Removal steps:

**CAUTION:**

Lift the engine unit carefully trying not to hit it on the deck or letting it fall hard on the hull.

- Suspend the engine unit using all three engine hangers, and then separate the unit from the engine mount.
- Remove the hoist cable from the front engine hanger and use the two rear engine hangers to suspend the engine unit.
- Lift the engine unit out vertically while turning it clockwise.



### Shim removal

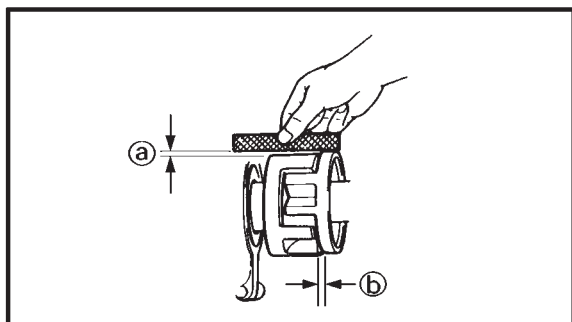
1. Remove:
  - Shims

### NOTE:

To ease reassembly and coupling alignment, remove the shims and organize them in their respective groups (e.g., front right, rear left) prior to removing the mounting bolts.

### Engine mount inspection

1. Inspect:
  - Engine mounts  
Cracks/damage → Replace.  
Refer to “ENGINE MOUNT” in Chapter 8.



### Coupling clearance inspection

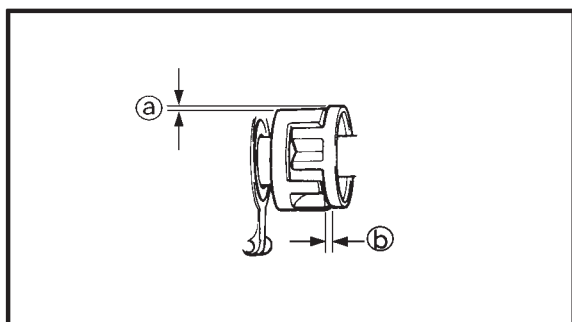
1. Measure:
  - Clearance (a)
  - Clearance (b)  
(with the rubber damper)  
Out of specification → Adjust.

### NOTE:

Measure the clearances with a straightedge and thickness gauge.



**Clearance (a):**  
0–0.5 mm (0–0.020 in)  
**Clearance (b):**  
2–4 mm (0.079–0.157 in)



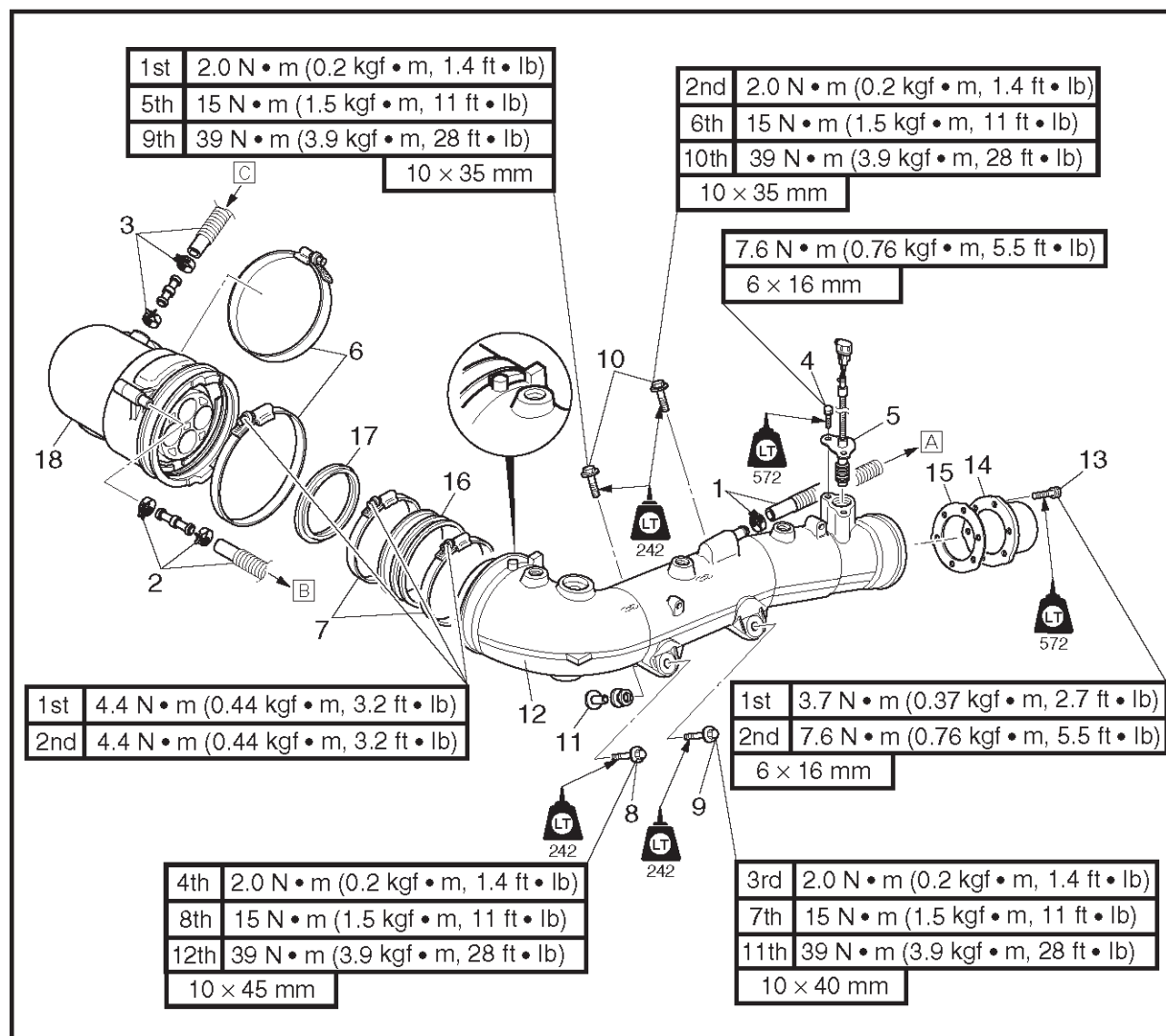
2. Adjust:
  - Clearance (a) and (b)

### Adjustment steps:

- Adjust the clearance (a) by adding or removing shims.
- Adjust the clearance (b) by moving the engine unit position.



## EXHAUST PIPE 3 EXPLODED DIAGRAM



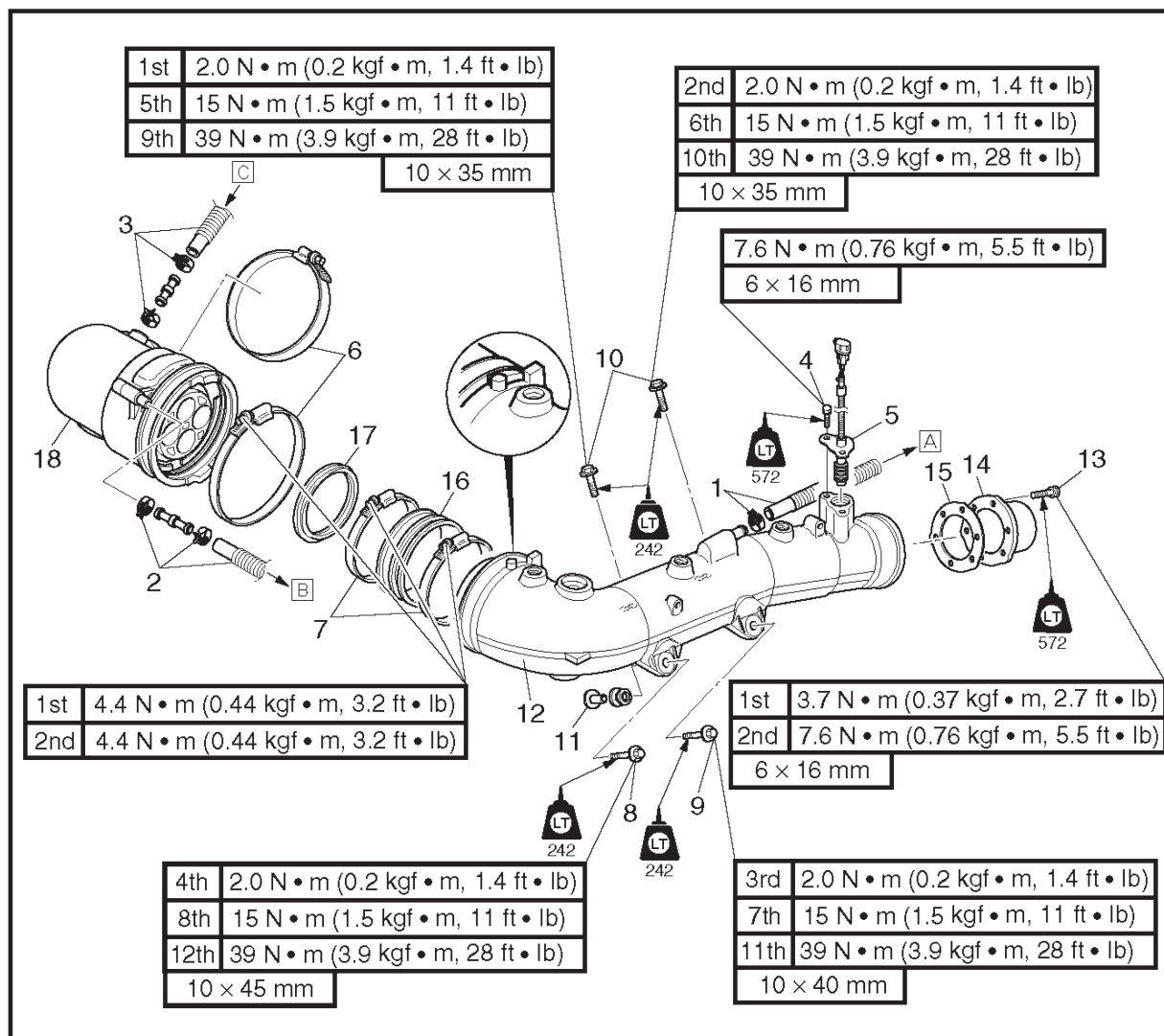
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>EXHAUST PIPE 3 REMOVAL</b>		
	Engine unit		Follow the left "Step" for removal.
	Air filter case		Refer to "ENGINE UNIT".
			Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
1	Clamp/cooling water hose	1/1	[A] For cooling water outlet on stern side
2	Clamp/cooling water hose	2/1	[B] For cooling water pilot outlet on port side
3	Clamp/cooling water hose	2/1	[C] From water jacket
4	Bolt	2	
5	Thermoswitch (exhaust)	1	



## EXHAUST PIPE 3 (Cont'd.)

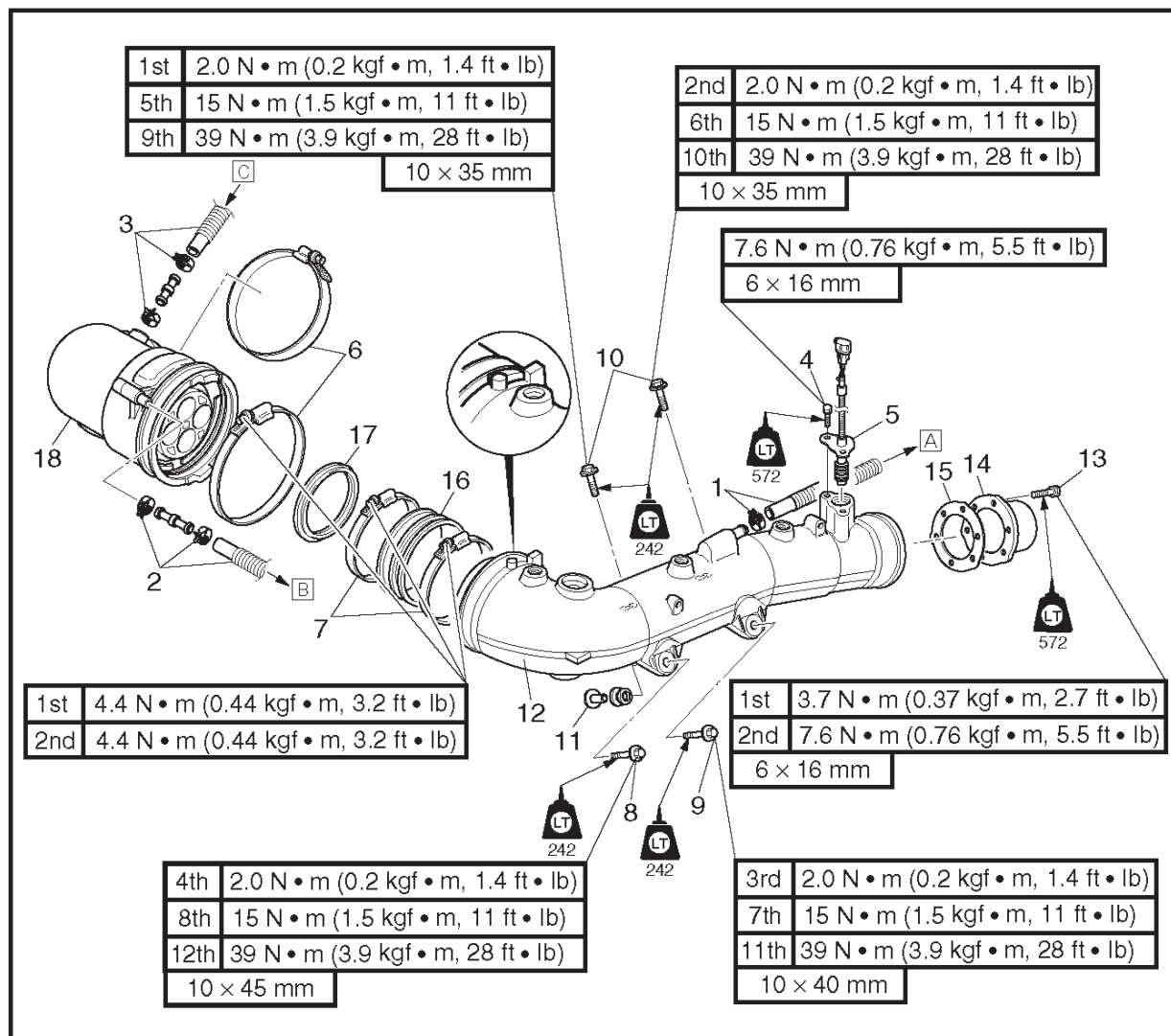
### EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
6	Exhaust joint clamp	2	Slide the outer exhaust joint for exhaust manifold side
7	Exhaust joint clamp	2	
8	Bolt	1	<b>NOTE:</b> _____ Tighten the bolts in the sequence indicated.
9	Bolt	1	
10	Bolt	2	
11	Collar	1	
12	Exhaust pipe 3	1	
13	Bolt	3	
14	Exhaust pipe end	1	



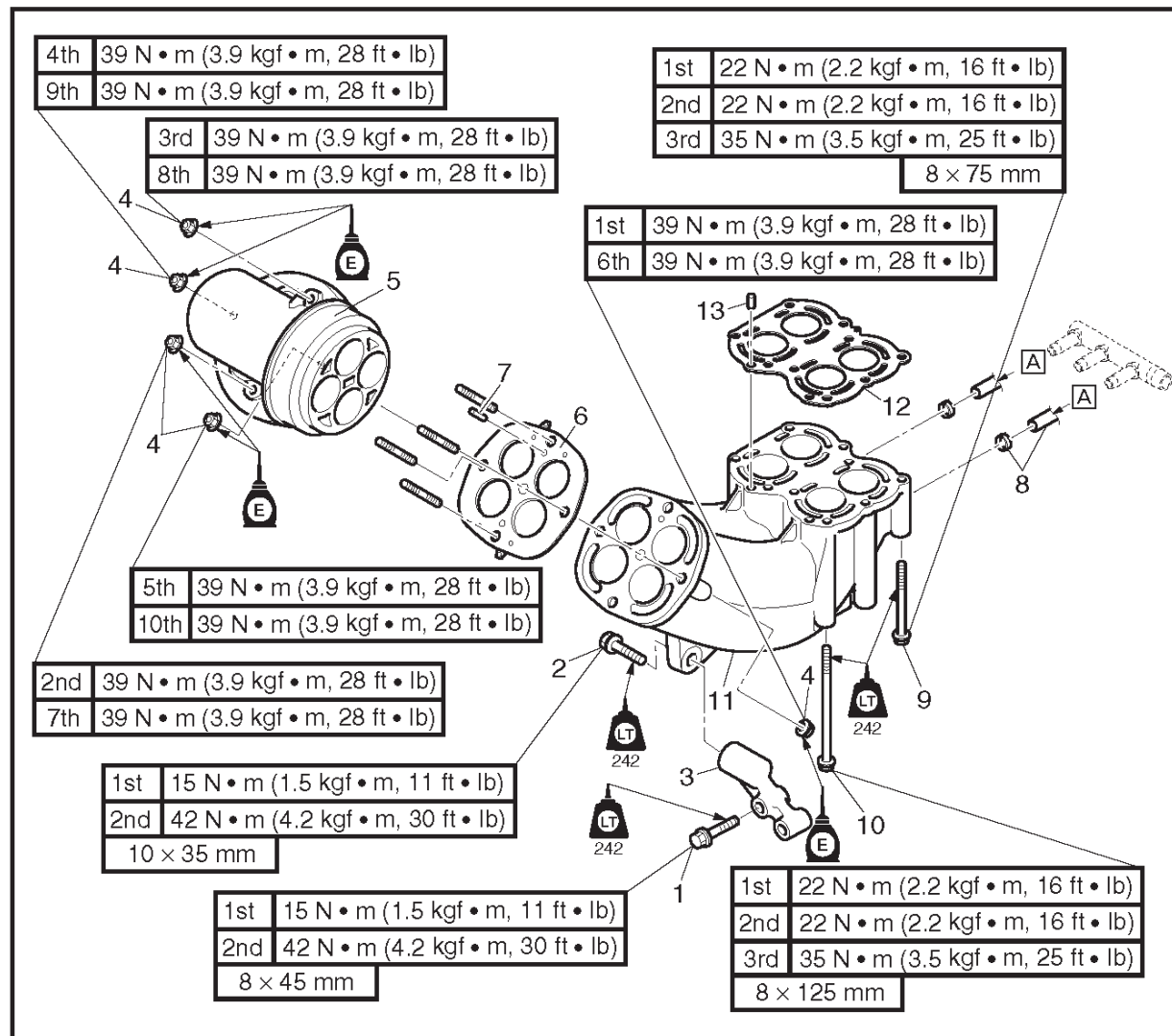
### EXHAUST PIPE 3 (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
15	Gasket	1	<b>Not reusable</b>
16	Inner exhaust joint	1	
17	Exhaust joint seal	1	
18	Outer exhaust joint	1	
Reverse the removal steps for installation.			



## EXHAUST PIPES 1 AND 2 EXPLODED DIAGRAM



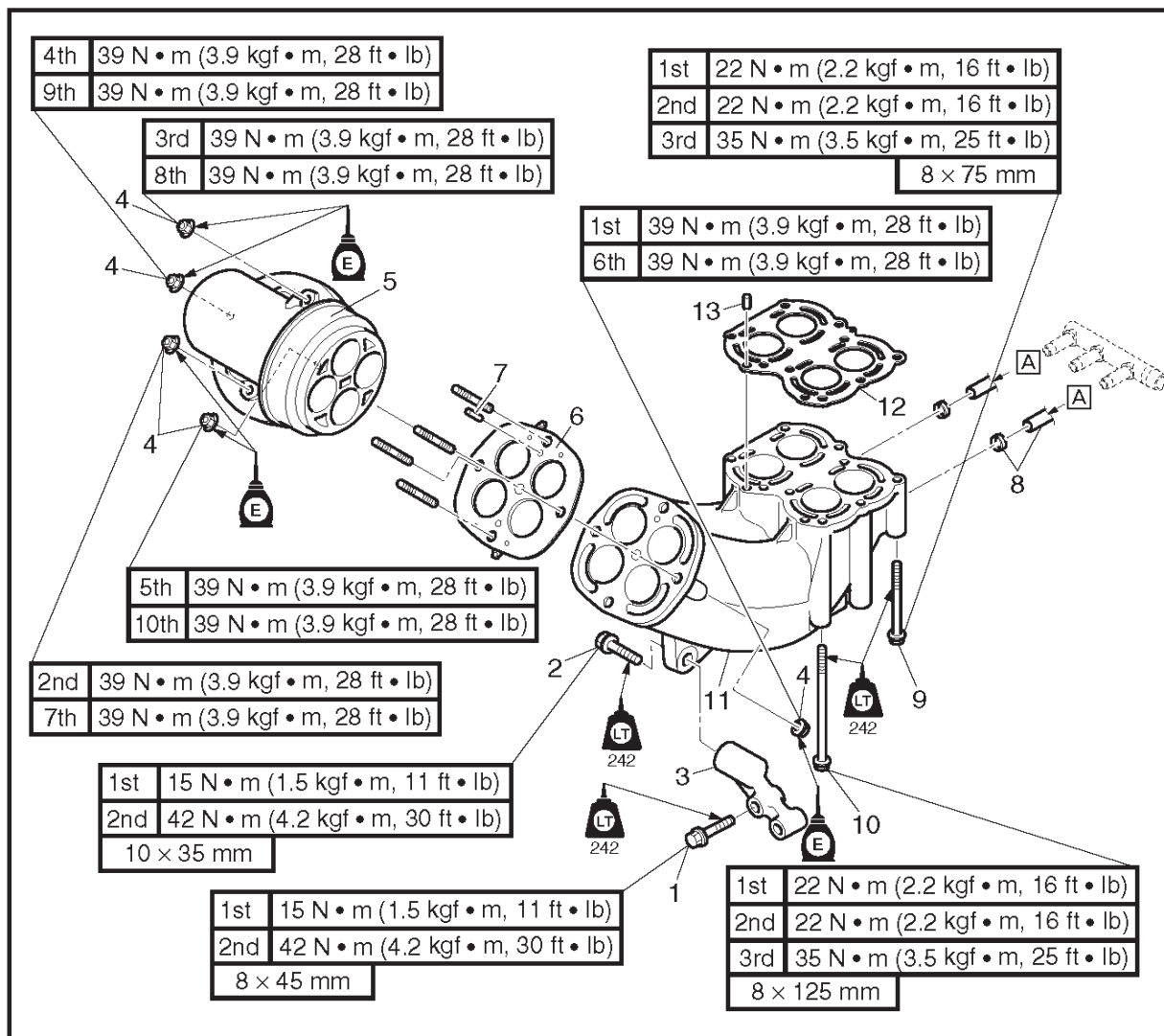
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>EXHAUST PIPES 1 AND 2 REMOVAL</b>		Follow the left "Step" for removal.
	Exhaust pipe 3		Refer to "EXHAUST PIPE 3".
	Generator cover		Refer to "GENERATOR AND STARTER MOTOR".
1	Bolt	2	<b>NOTE:</b> _____ Tighten the nuts in the sequence indicated.
2	Bolt	1	
3	Exhaust pipe stay	1	
4	Nut	5	
5	Exhaust pipe 2	1	





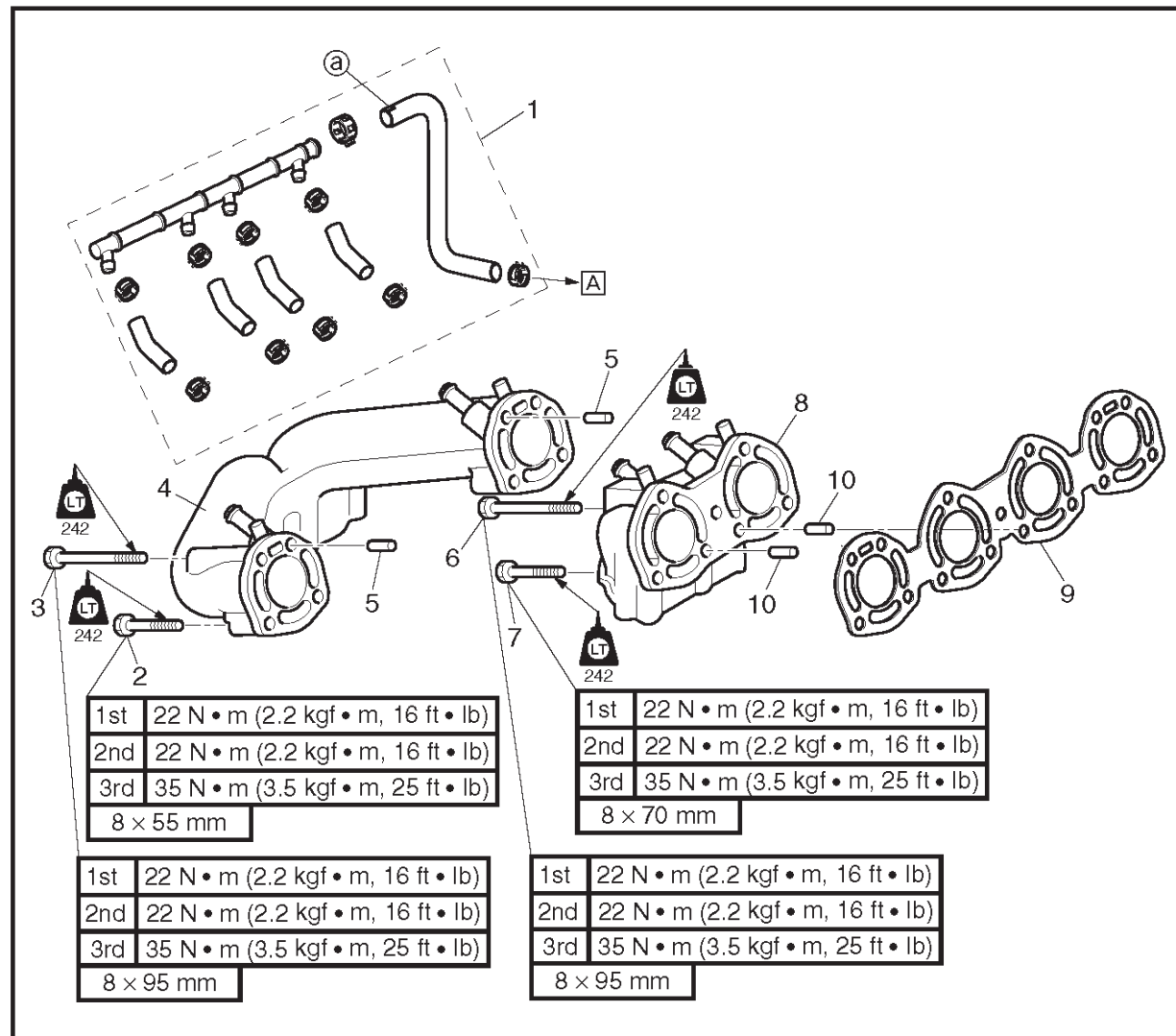
## EXHAUST PIPES 1 AND 2 (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
6	Gasket	1	<b>Not reusable</b>
7	Dowel pin	2	
8	Clamp/cooling water hose	2/2	<b>A</b> From cooling water inlet
9	Bolt	4	
10	Bolt	6	
11	Exhaust pipe 1	1	
12	Gasket	1	<b>Not reusable</b>
13	Dowel pin	2	
Reverse the removal steps for installation.			



## EXHAUST MANIFOLD EXPLODED DIAGRAM



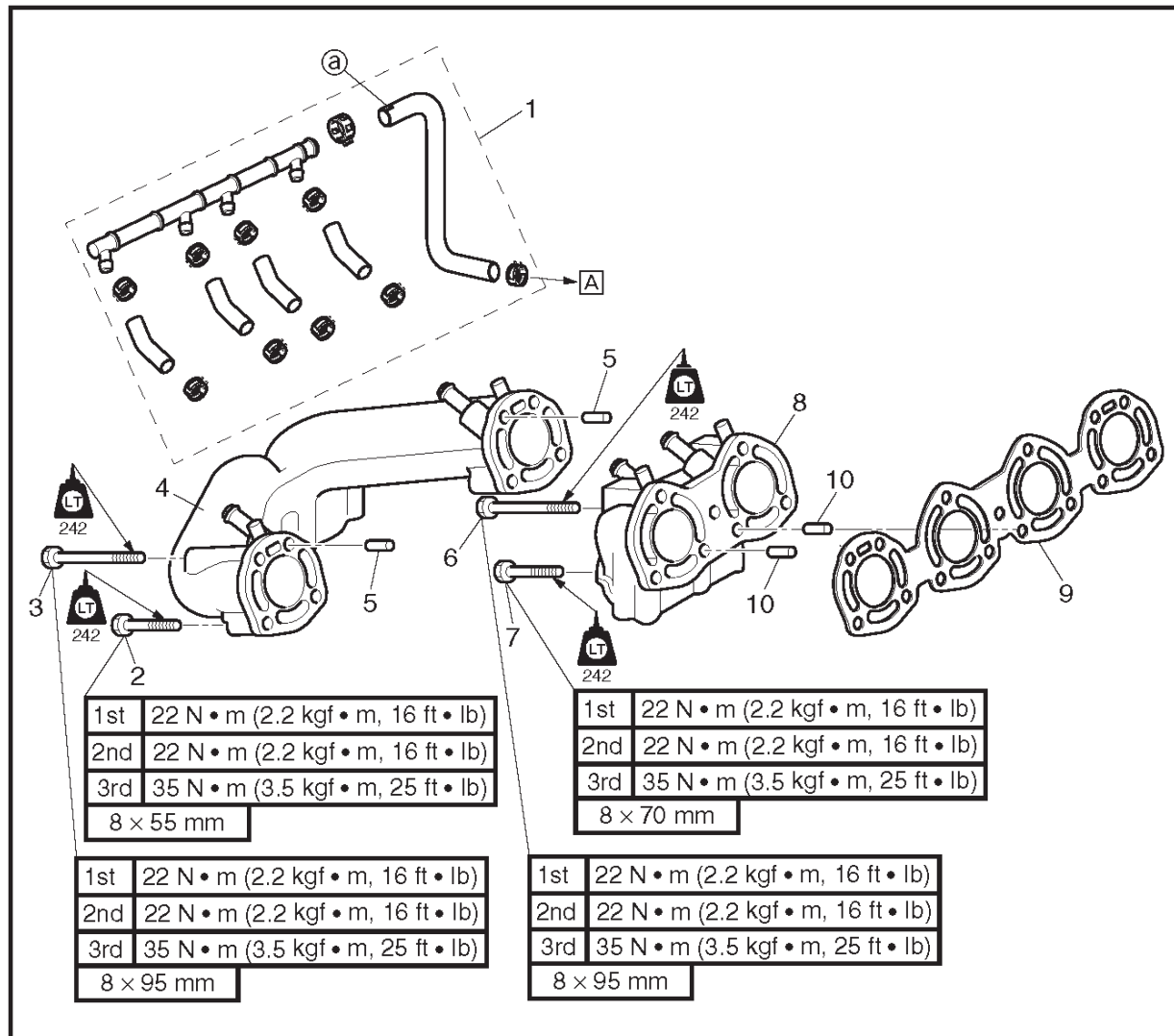
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
1	<b>EXHAUST MANIFOLD REMOVAL</b>		Follow the left "Step" for removal.
	Exhaust pipes 1 and 2		Refer to "EXHAUST PIPES 1 AND 2".
	Joint assembly	1	<b>A</b> To cylinder block
			<b>NOTE:</b> _____
			Install the cooling water hose with the white mark <b>a</b> facing up.
2	Bolt	2	
3	Bolt	4	
4	Exhaust manifold 1	1	
5	Dowel pin	2	



## EXHAUST MANIFOLD (Cont'd.)

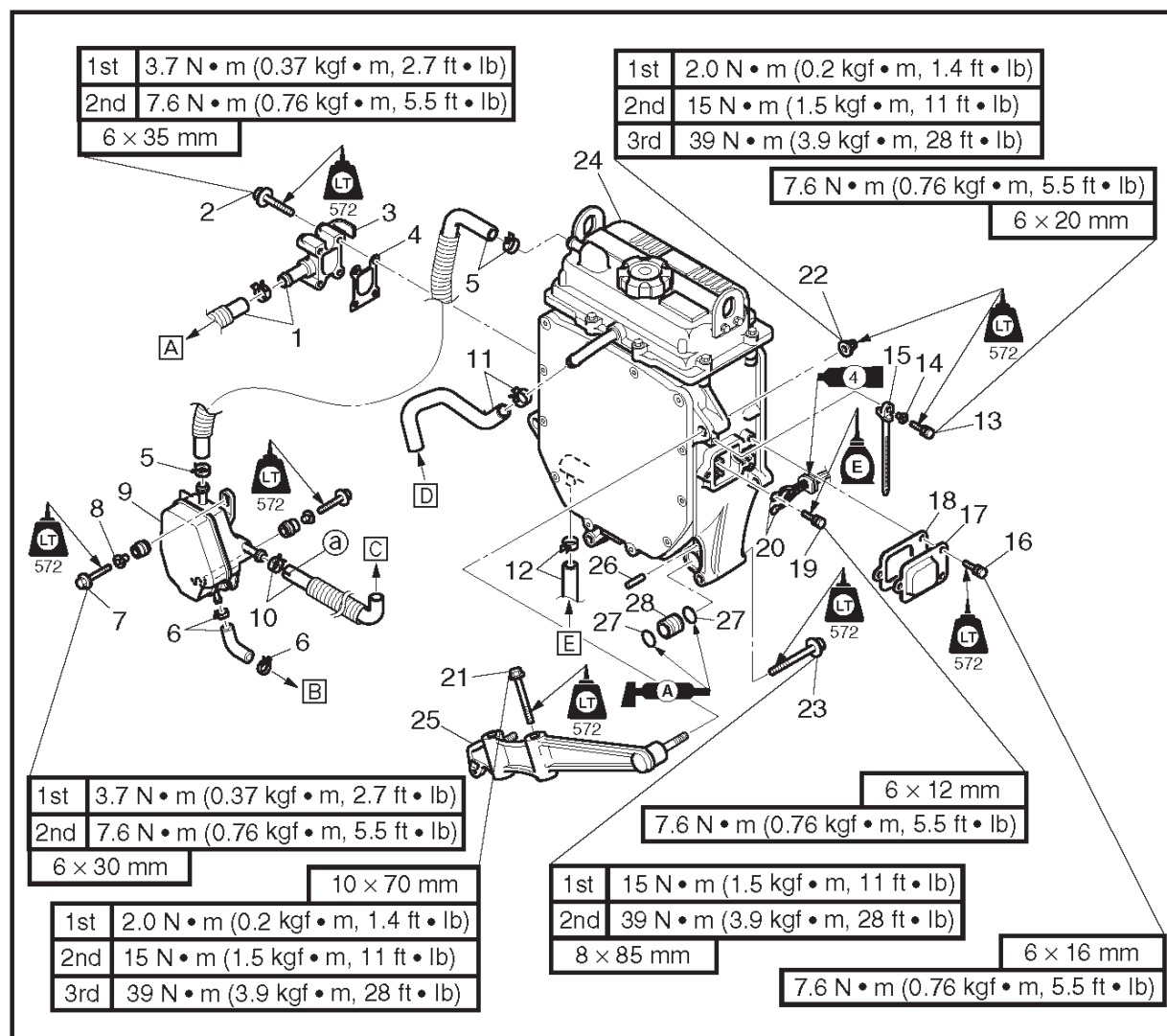
### EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
6	Bolt	1	<div>Not reusable</div> <div>Reverse the removal steps for installation.</div>
7	Bolt	4	
8	Exhaust manifold 2	1	
9	Gasket	1	
10	Dowel pin	2	



## OIL TANK EXPLODED DIAGRAM

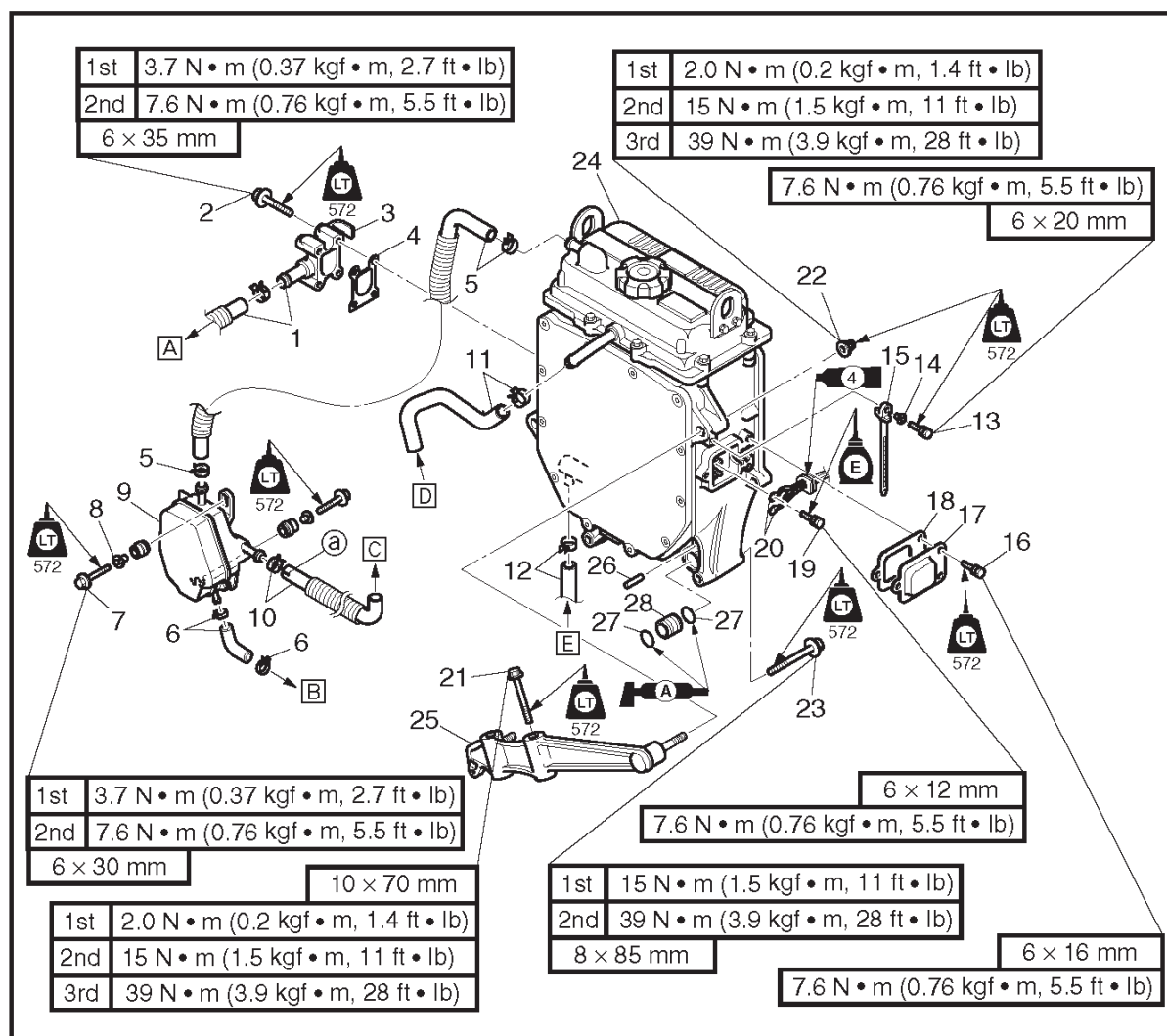


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>OIL TANK REMOVAL</b>		
	Engine unit		Follow the left "Step" for removal.
	Air filter case		Refer to "ENGINE UNIT".
	Thermostat housing		Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
	Clamp/cooling water hose		Refer to "THERMOSTAT".
1	Clamp/cooling water hose	1/1	[A] To exhaust joint
2	Bolt	4	
3	Water jacket	1	
4	Gasket	1	<b>Not reusable</b>
5	Clamp/breather hose	2/1	
6	Clamp/breather hose	2/1	[B] To oil pump



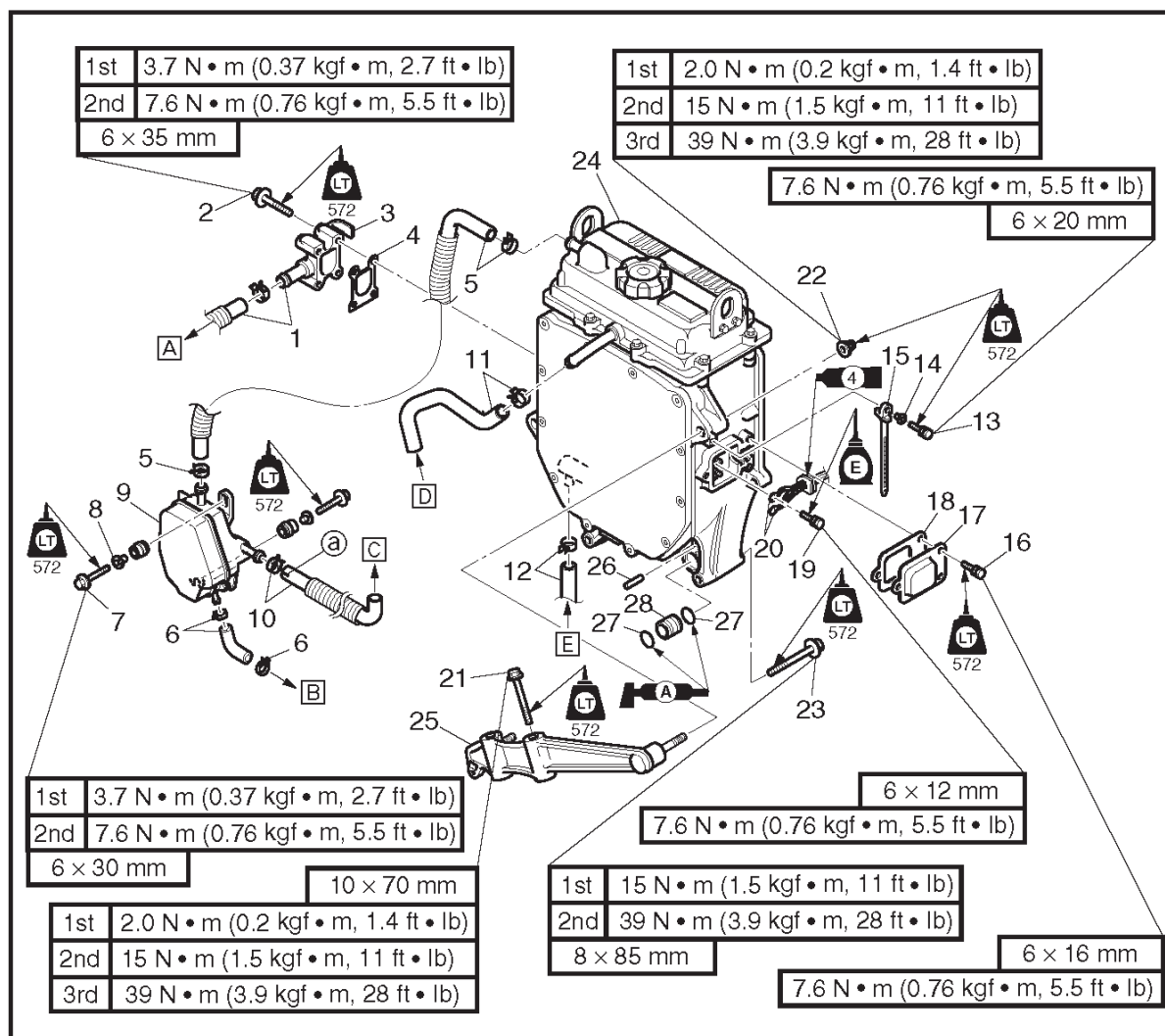
## OIL TANK (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
7	Bolt	2	
8	Collar	2	
9	Oil separator	1	
10	Clamp/breather hose	1/1	☐ To air filter case Mark ②
11	Clamp/breather hose	1/1	☐ From cylinder head cover
12	Clamp/cooling water hose	1/1	☐ From cooling water inlet
13	Bolt	1	
14	Collar	1	
15	Band	1	
16	Bolt	3	
17	Cover	1	



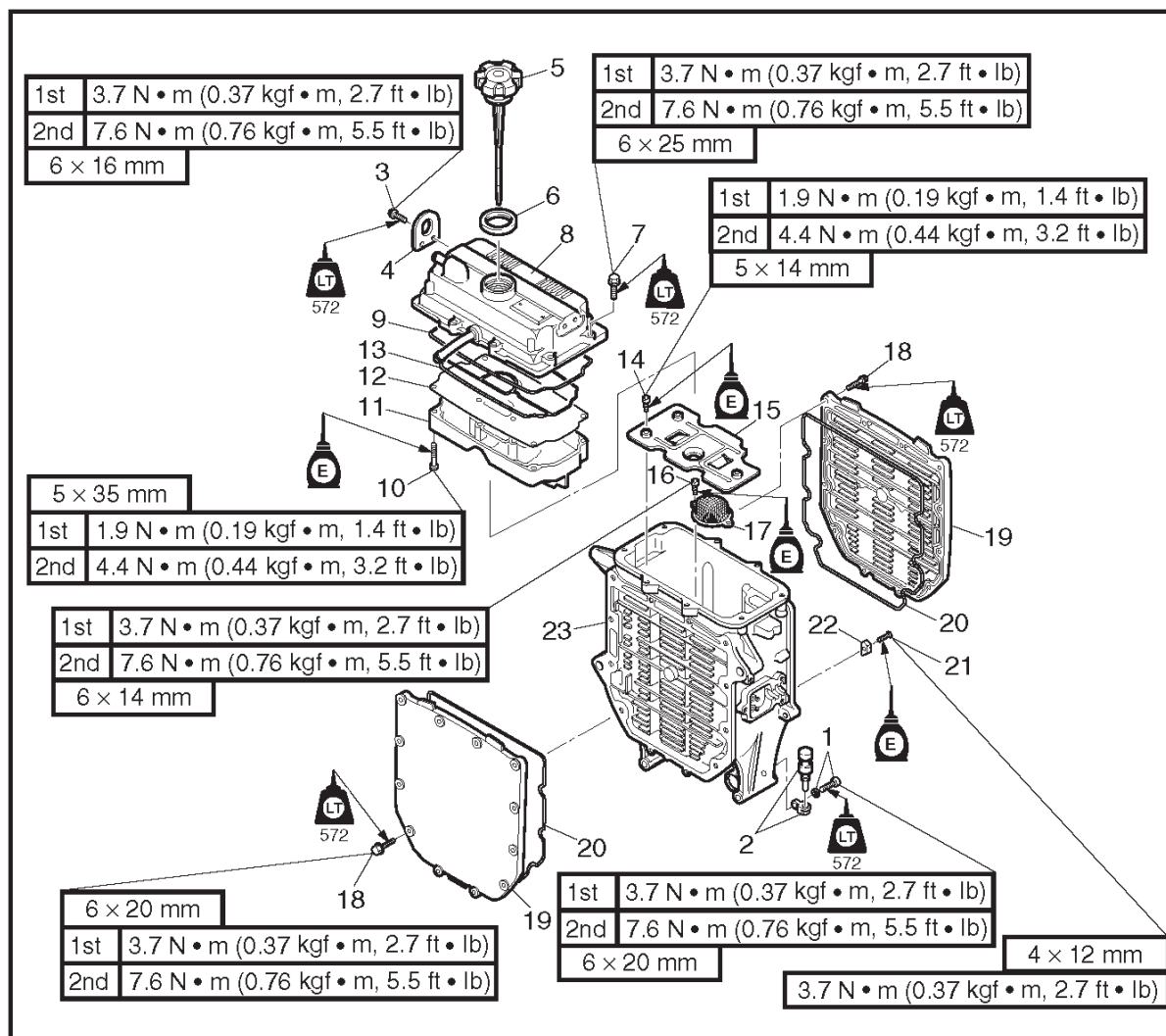
## OIL TANK (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
18	Gasket	1	Not reusable
19	Bolt	2	
20	Ground lead	2	
21	Bolt	2	
22	Nut	2	
23	Bolt	5	
24	Oil tank	1	Not reusable
25	Oil tank stay	1	
26	Pin	2	
27	O-ring	4	
28	Connector	2	
Reverse the removal steps for installation.			



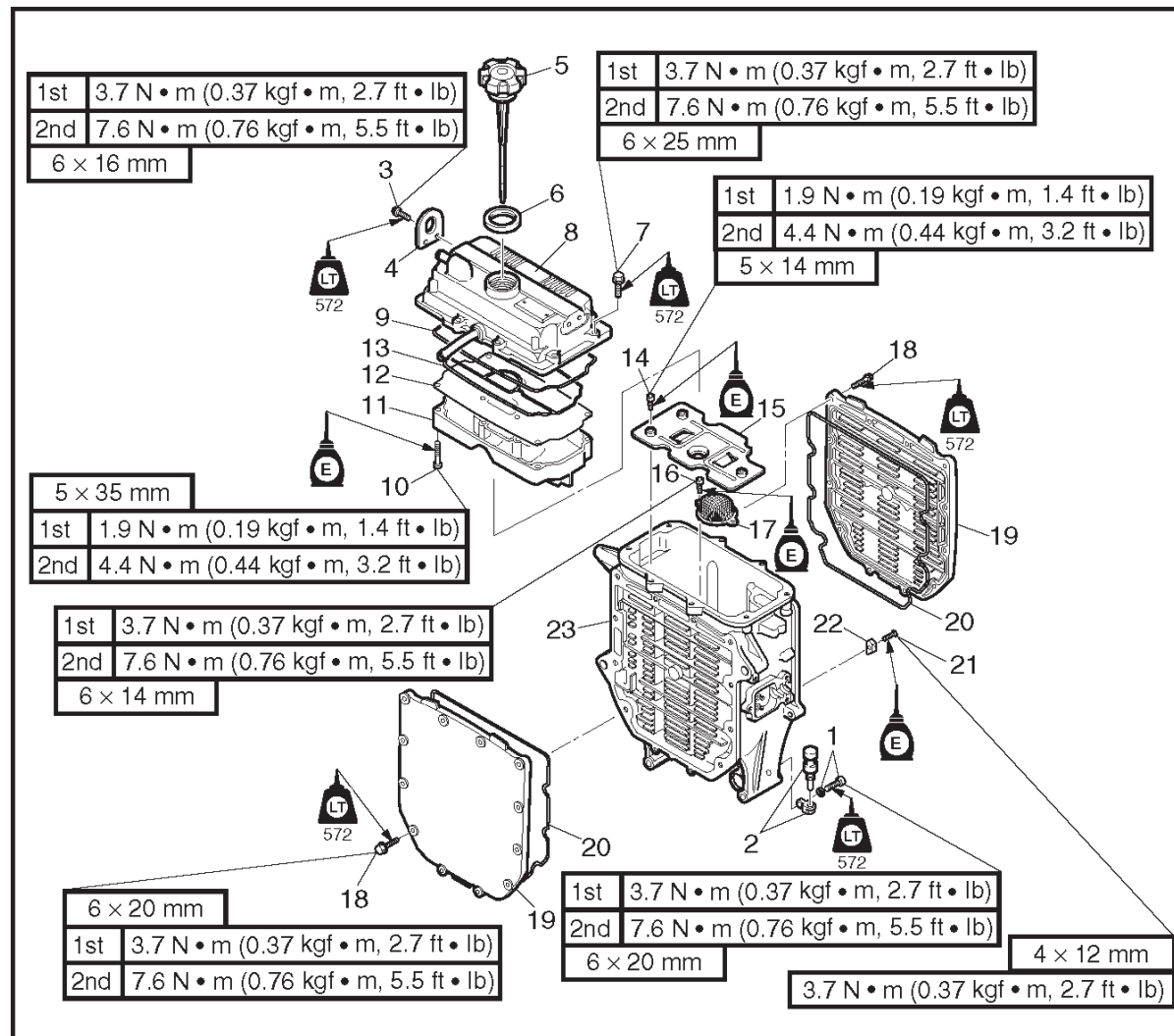
## OIL TANK (Cont'd.) EXPLODED DIAGRAM



## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>OIL TANK DISASSEMBLY</b>		Follow the left "Step" for disassembly.
1	Bolt/washer	2/2	
2	Bracket/grommet	2/2	
3	Bolt	4	
4	Hunger	2	
5	Oil tank filler cap	1	
6	Packing	1	
7	Bolt	8	
8	Oil tank cover	1	
9	Gasket	1	<b>Not reusable</b>
10	Bolt	10	

### OIL TANK (Cont'd.) EXPLODED DIAGRAM

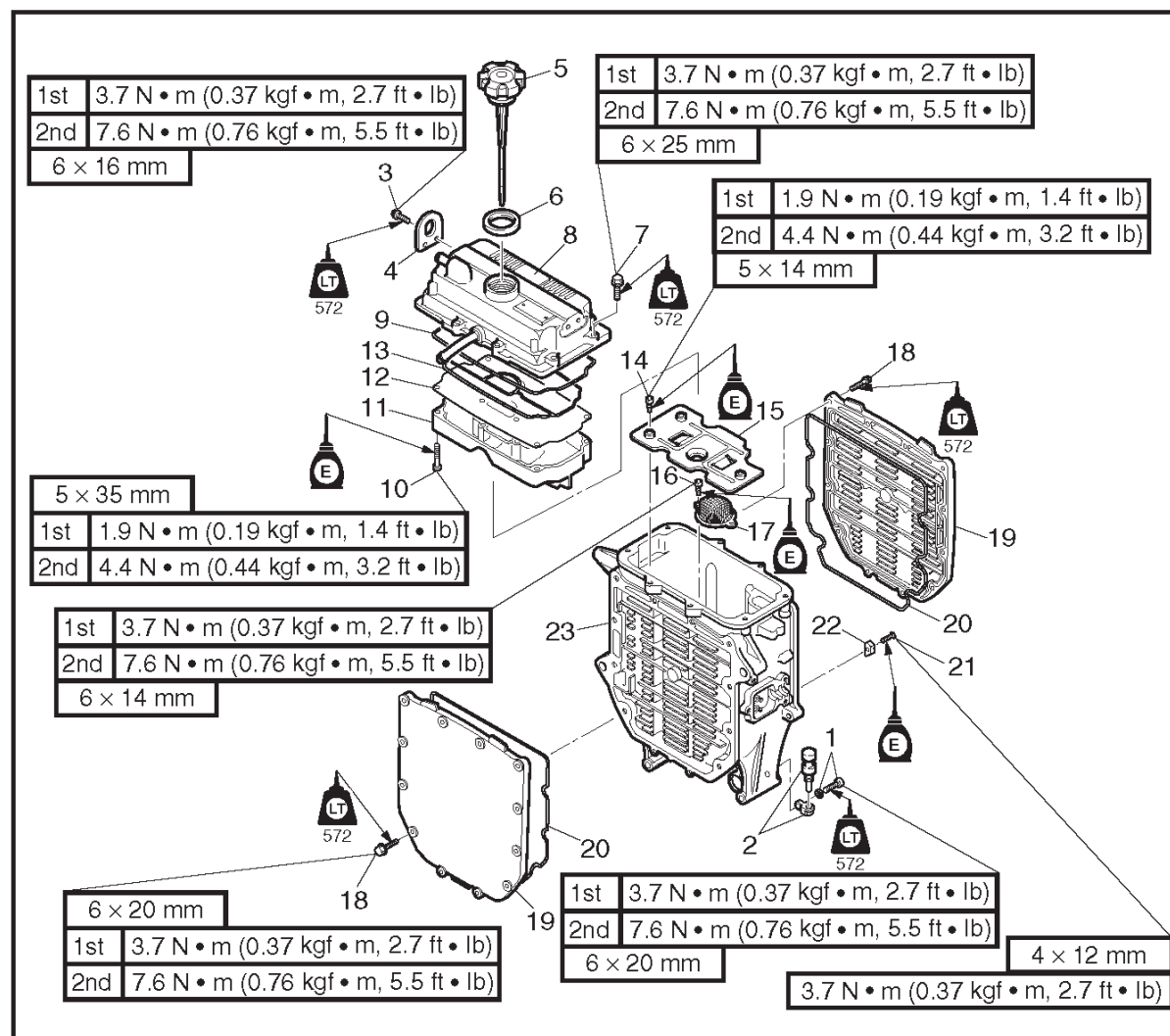


Step	Procedure/Part name	Q'ty	Service points
11	Oil breather plate 1	1	Not reusable
12	Oil breather plate 2	1	
13	Gasket	1	
14	Bolt	3	
15	Baffle plate	1	
16	Bolt	2	
17	Oil strainer	1	
18	Bolt	24	
19	Oil cooler cover	2	
20	Gasket	2	
			Not reusable





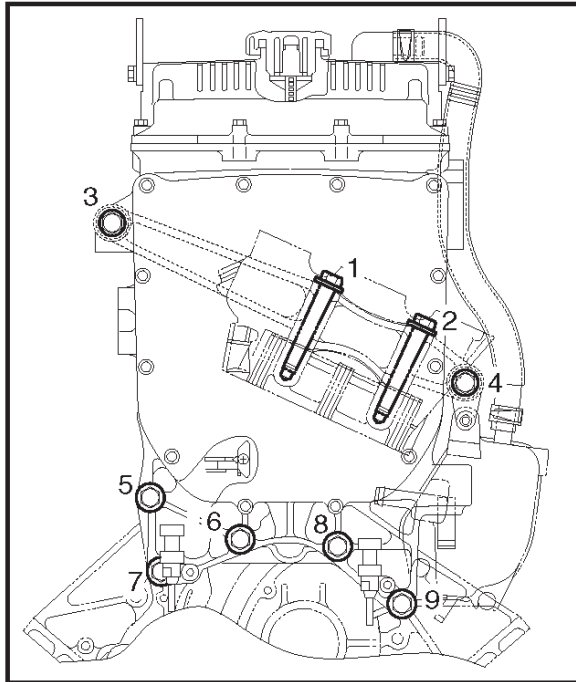
## OIL TANK (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
21	Screw	1	Reverse the disassembly steps for assembly.
22	Anode	1	
23	Oil tank	1	



## OIL TANK (Cont'd.)



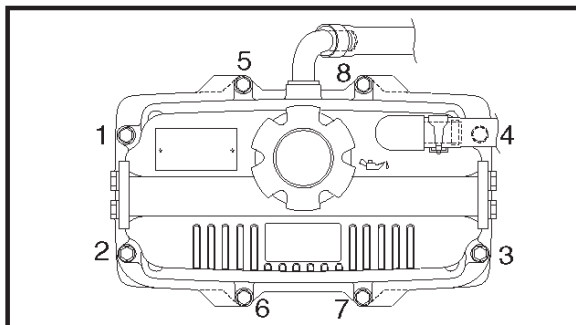
## SERVICE POINTS

## Oil tank removal

1. Remove:
  - Oil tank

**NOTE:**

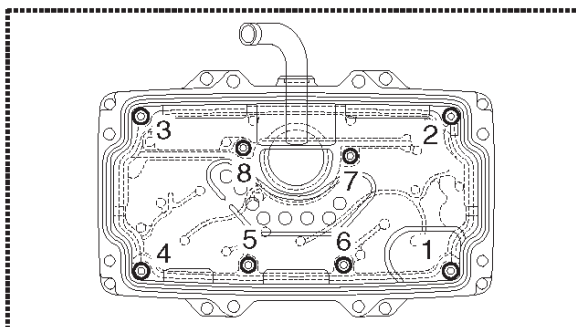
Loosen the oil tank bolts and nuts in the sequence shown.



2. Remove:
  - Oil tank cover
  - Gasket

**NOTE:**

Loosen the oil tank cover bolts in the sequence shown.



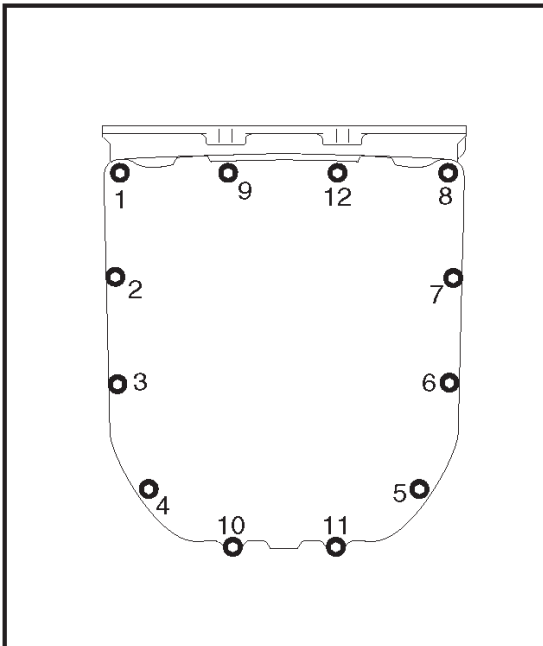
3. Remove:
  - Oil breather plate 1
  - Oil breather plate 2
  - Gasket

**NOTE:**

Loosen the oil breather plate bolts in the sequence shown.



## OIL TANK (Cont'd.)

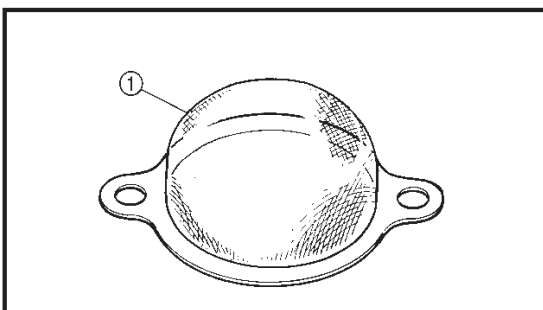


## 4. Remove:

- Oil cooler covers
- Gaskets

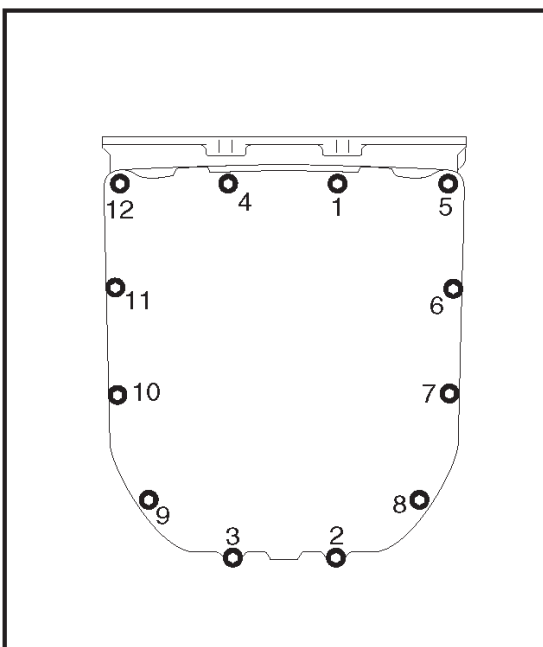
**NOTE:**

Loosen the oil cooler cover bolts in the sequence shown.

**Oil strainer inspection**

## 1. Check:

- Oil strainer ①  
Damage → Replace.  
Contaminants → Clean.

**Oil tank installation**

## 1. Install:

- Gaskets
- Oil cooler covers

**NOTE:**

Tighten the oil cooler bolts in the sequence shown.

**Oil cooler cover bolt:**

## 1st:

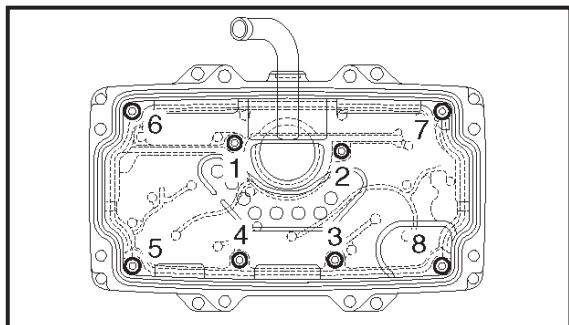
3.7 N • m  
(0.37 kgf • m, 2.7 ft • lb)

## 2nd:

7.6 N • m  
(0.76 kgf • m, 5.5 ft • lb)  
LOCTITE 572



## OIL TANK (Cont'd.)



## 2. Install:

- Gasket
- Oil breather plate 2
- Oil breather plate 1

**NOTE:**

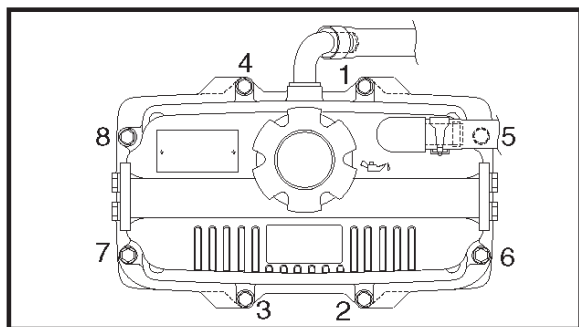
Tighten the oil breather plate bolts in the sequence shown.

**Oil breather plate bolt:****1st:**

1.9 N • m  
(0.19 kgf • m, 1.4 ft • lb)

**2nd:**

4.4 N • m  
(0.44 kgf • m, 3.2 ft • lb)



## 3. Install:

- Gasket
- Oil tank cover

**NOTE:**

Tighten the oil tank cover bolts in the sequence shown.

**Oil tank cover bolt:****1st:**

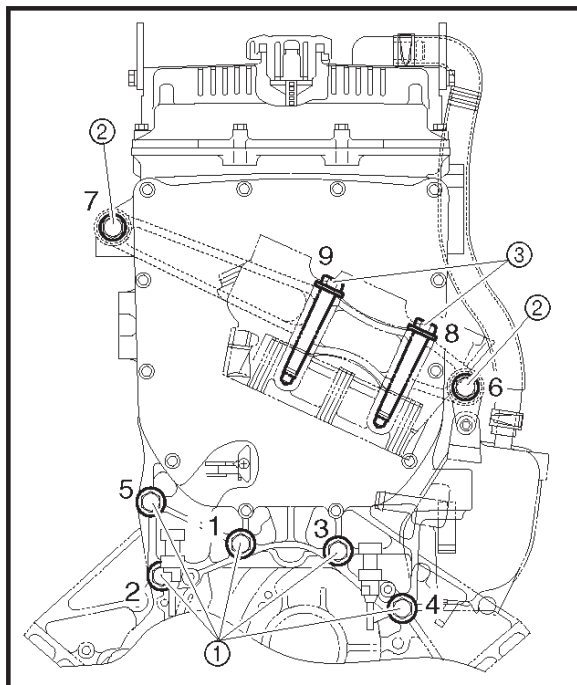
3.7 N • m  
(0.37 kgf • m, 2.7 ft • lb)

**2nd:**

7.6 N • m  
(0.76 kgf • m, 5.5 ft • lb)  
LOCTITE 572



## OIL TANK (Cont'd.)



4. Install:

- Oil tank

**NOTE:**

Tighten the oil tank nuts and bolts in the sequence shown.

**Bolt ①:**

1st:

15 N • m (1.5 kgf • m, 11 ft • lb)

2nd:

39 N • m (3.9 kgf • m, 28 ft • lb)

LOCTITE 572

**Nut ②, bolt ③:**

1st:

2.0 N • m (0.2 kgf • m, 1.4 ft • lb)

2nd:

15 N • m (1.5 kgf • m, 11 ft • lb)

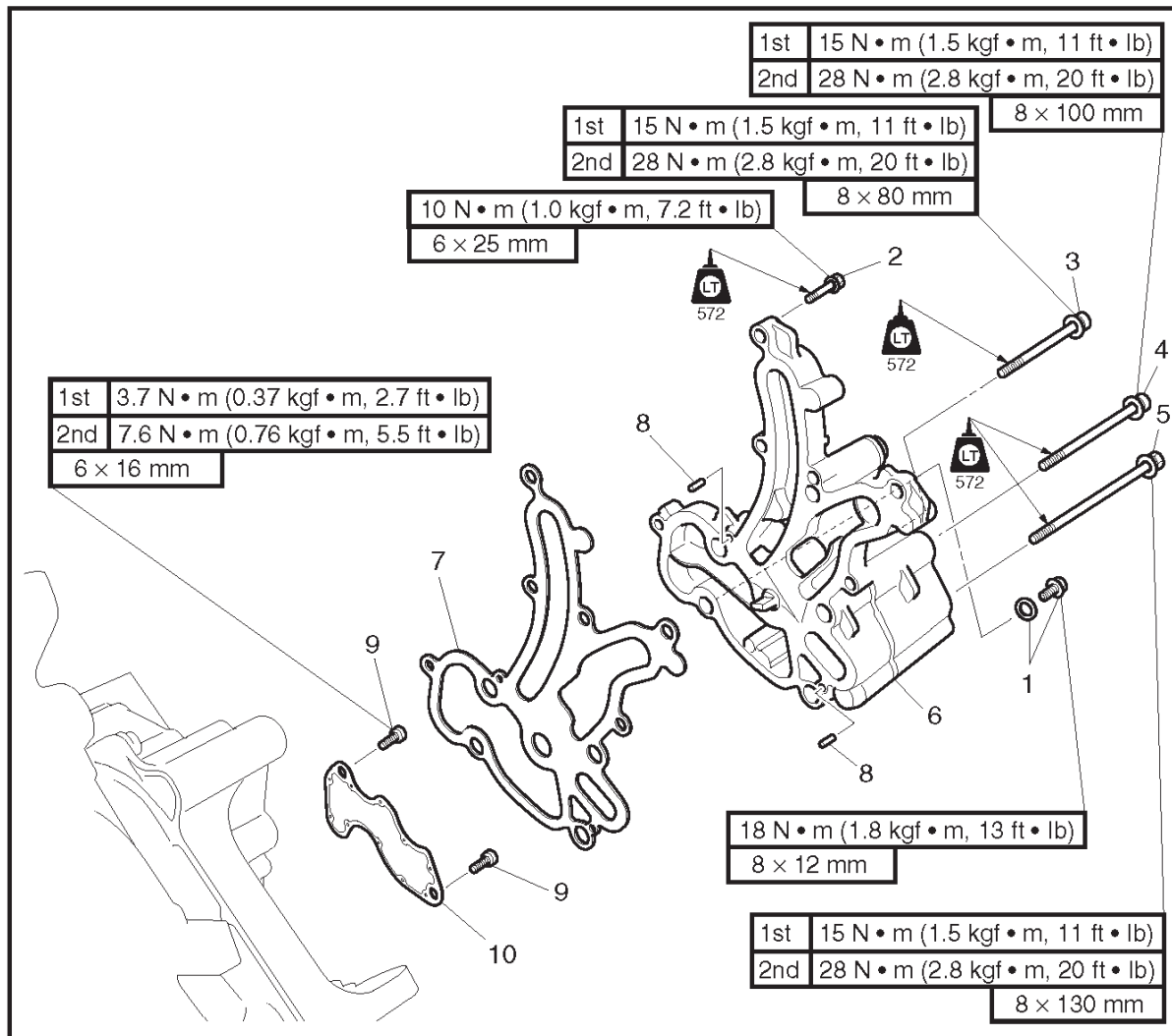
3rd:

39 N • m (3.9 kgf • m, 28 ft • lb)

LOCTITE 572



## OIL PUMP EXPLODED DIAGRAM

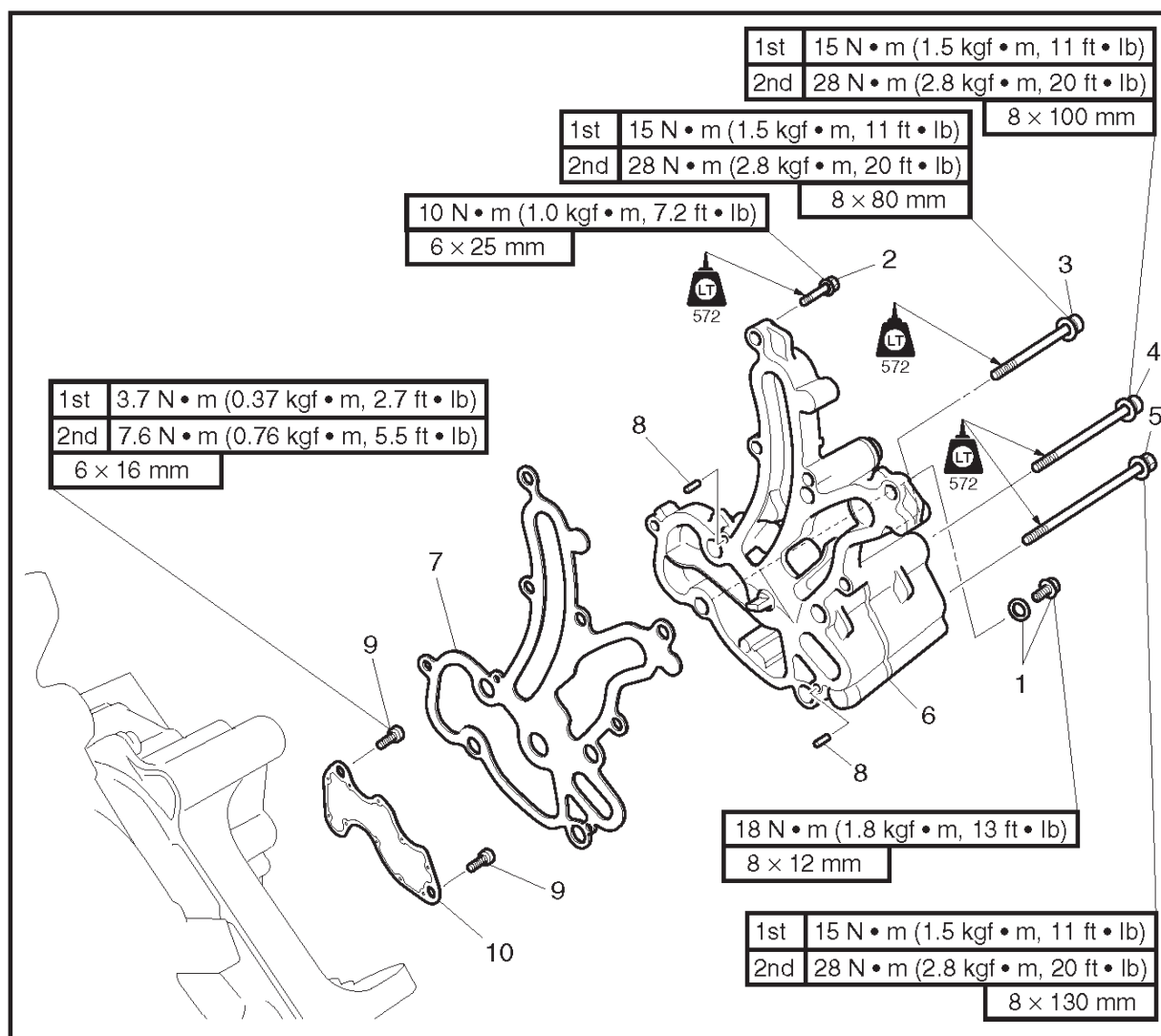


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>OIL PUMP ASSEMBLY REMOVAL</b>		Follow the left "Step" for removal.
	Oil tank		Refer to "OIL TANK".
1	Drain plug/washer	1/1	Drain engine oil.
2	Bolt	6	
3	Bolt	1	
4	Bolt	1	
5	Bolt	2	
6	Oil pump assembly	1	
7	Gasket	1	<b>Not reusable</b>
8	Pin	2	



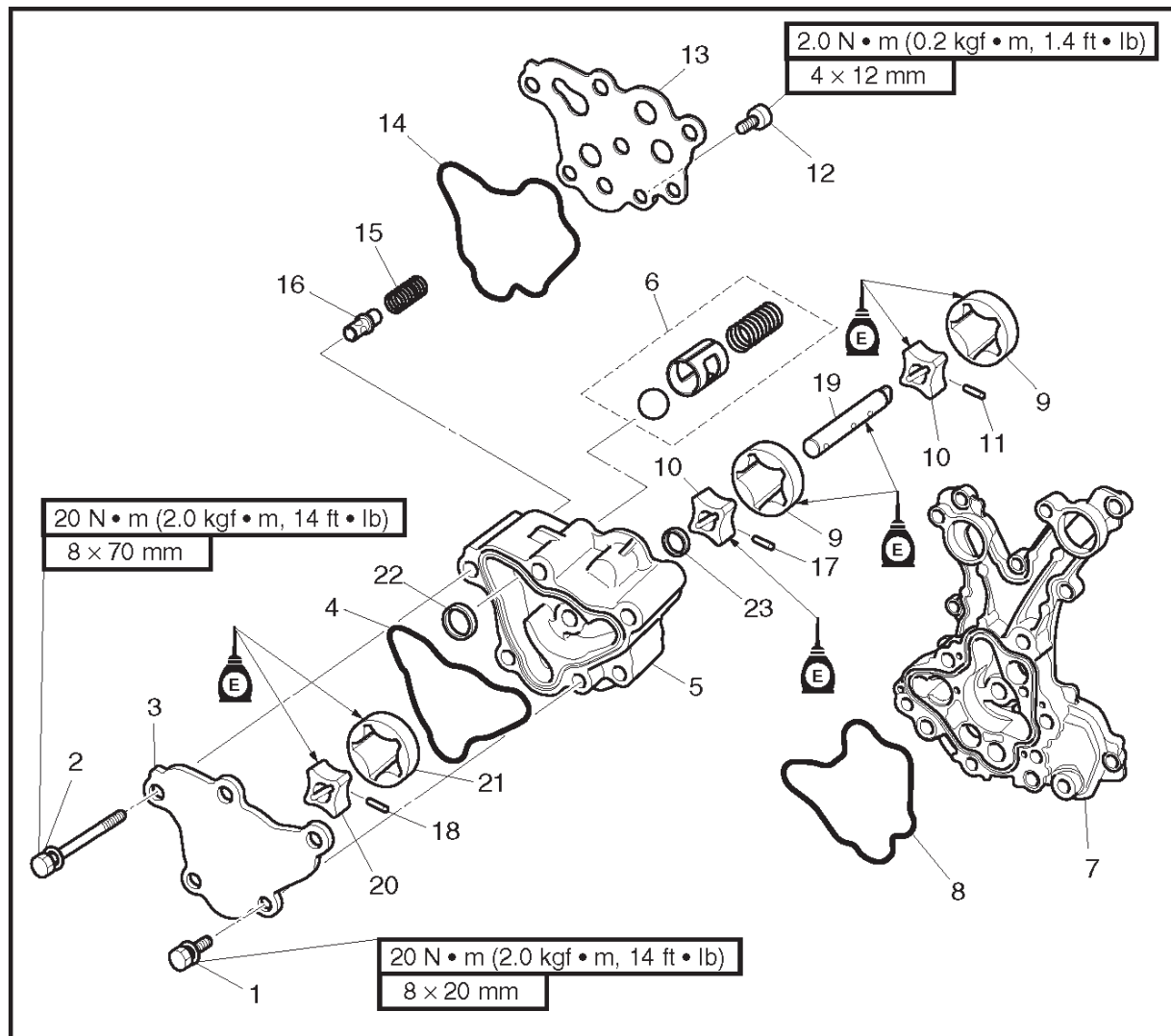
## OIL PUMP (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
9	Bolt	2	Reverse the removal steps for installation.
10	Strainer	1	



## OIL PUMP (Cont'd.) EXPLODED DIAGRAM



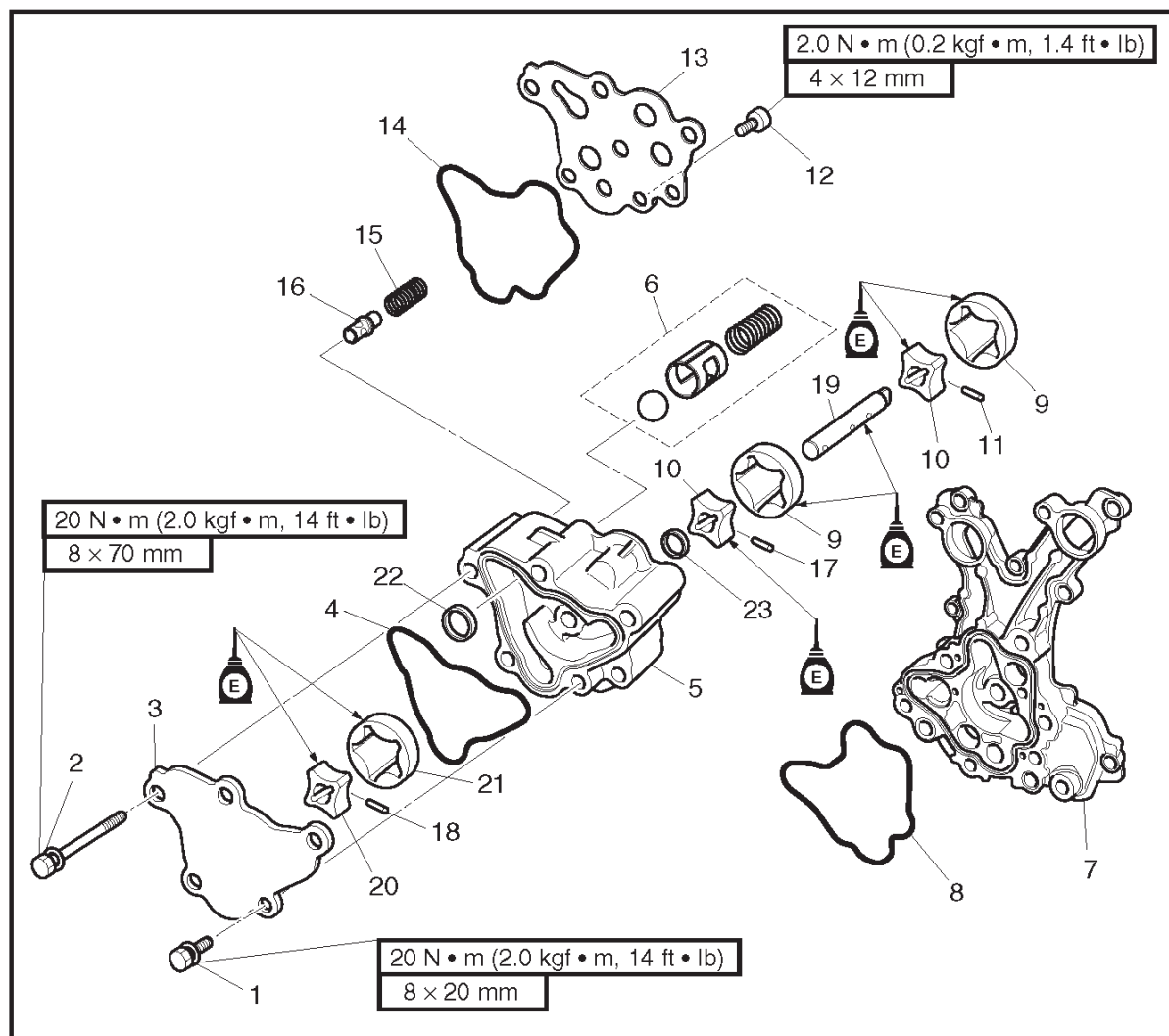
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>OIL PUMP DISASSEMBLY</b>		Follow the left "Step" for disassembly.
1	Bolt	1	
2	Bolt	3	
3	Oil pump housing cover 1	1	
4	Gasket	1	<b>Not reusable</b>
5	Oil pump housing 1	1	
6	Check valve assembly	1	
7	Oil pump housing 2	1	
8	Gasket	1	<b>Not reusable</b>
9	Outer rotor (scavenge)	2	
10	Inner rotor (scavenge)	2	





## OIL PUMP (Cont'd.) EXPLODED DIAGRAM

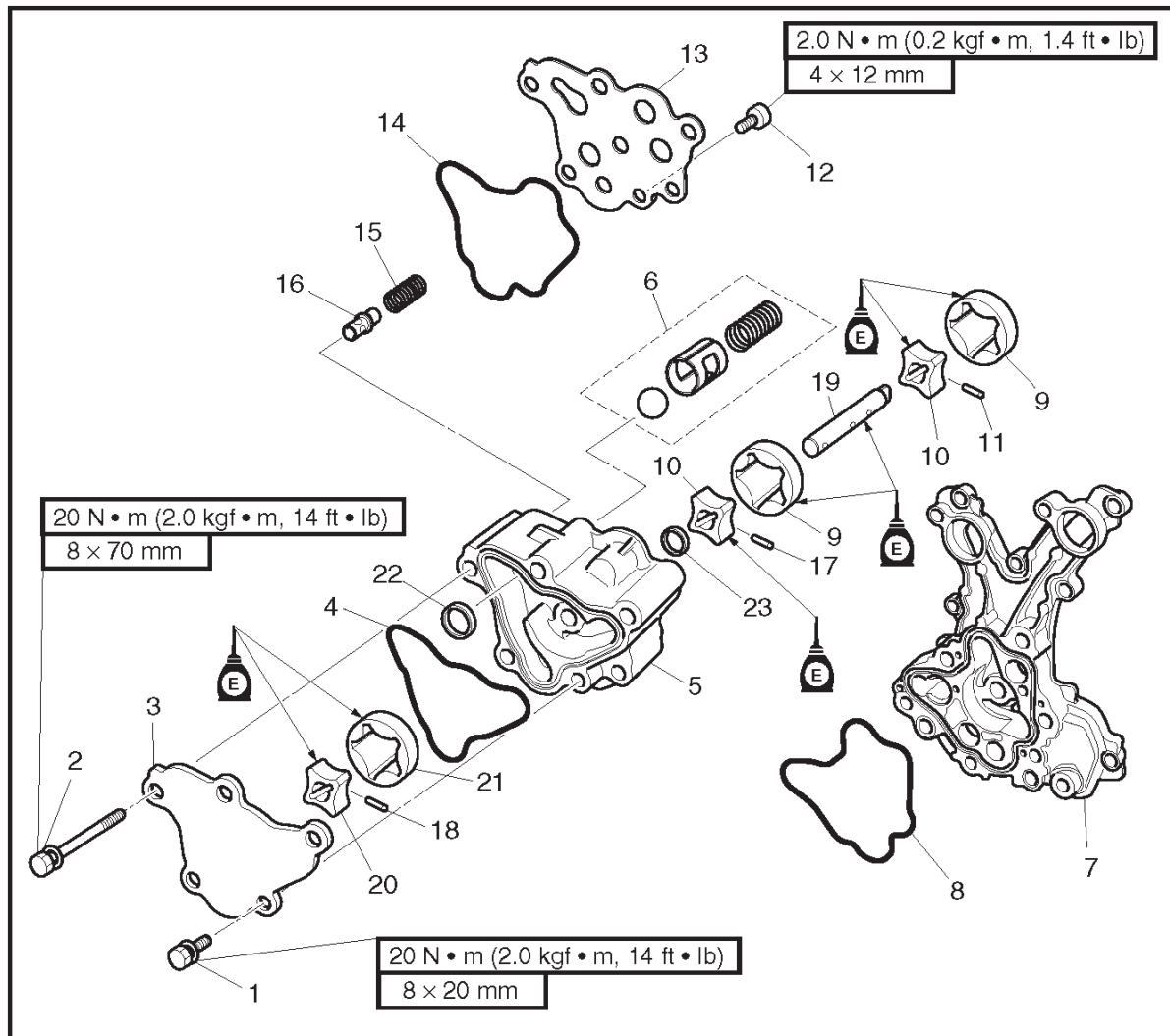


Step	Procedure/Part name	Q'ty	Service points
11	Pin	1	<b>Not reusable</b>
12	Screw	1	
13	Oil pump housing cover 2	1	
14	Gasket	1	
15	Spring	1	
16	Plunger	1	
17	Pin	1	
18	Pin	1	
19	Oil pump shaft	1	
20	Inner rotor (feed)	1	
21	Outer rotor (feed)	1	



## OIL PUMP (Cont'd.)

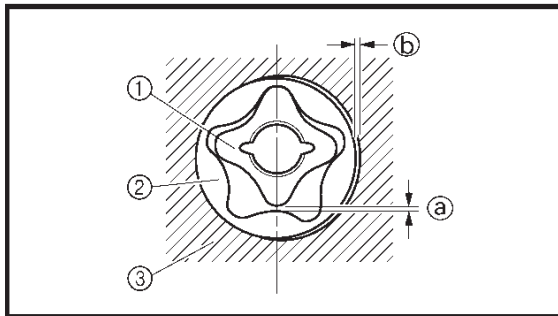
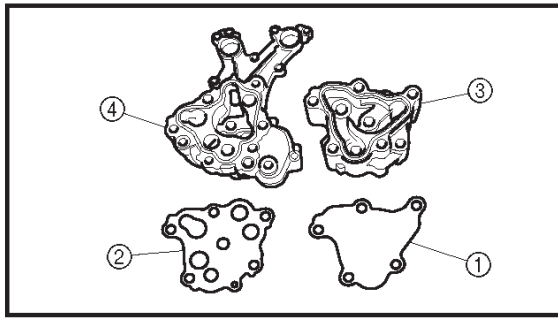
## EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
22	Check valve seat	1	<b>Not reusable</b> Reverse the disassembly steps for assembly.
23	Oil seal	1	



## OIL PUMP (Cont'd.)



## SERVICE POINTS

## Oil pump inspection

## 1. Check:

- Oil pump housing cover 1 (1)
- Oil pump housing cover 2 (2)
- Oil pump housing 1 (3)
- Oil pump housing 2 (4)

Cracks/damage/wear → Replace the defective part(s).

## 2. Measure:

- Inner-rotor-to-outer-rotor-tip clearance (a)
- Outer-rotor-to-oil-pump-housing clearance (b)

Out of specification → Replace the oil pump.

- ① Inner rotor
- ② Outer rotor
- ③ Oil pump housing

**Inner-rotor-to-outer-rotor-tip clearance (a):**

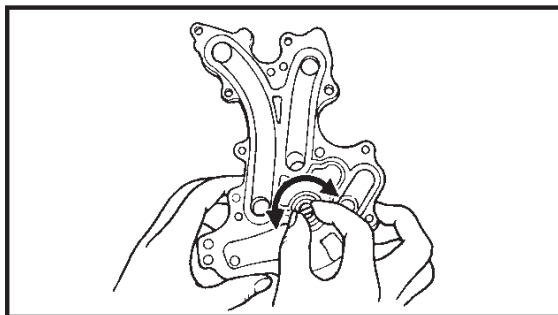
0.09–0.15 mm (0.0035–0.0059 in)

**Outer-rotor-to-oil-pump-housing clearance (b) (scavenge pump):**

0.09–0.15 mm (0.0035–0.0059 in)

**Outer-rotor-to-oil-pump-housing clearance (b) (feed pump):**

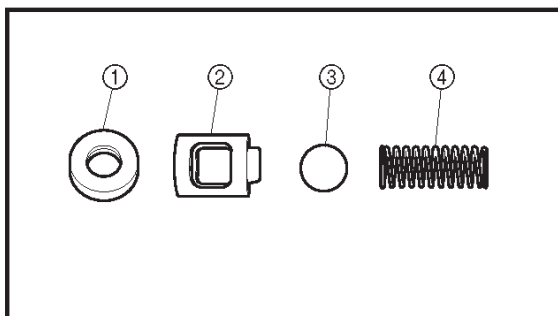
0.09–0.17 mm (0.0035–0.0067 in)



## 3. Check:

- Oil pump operation

Rough movement → Replace the defective part(s).

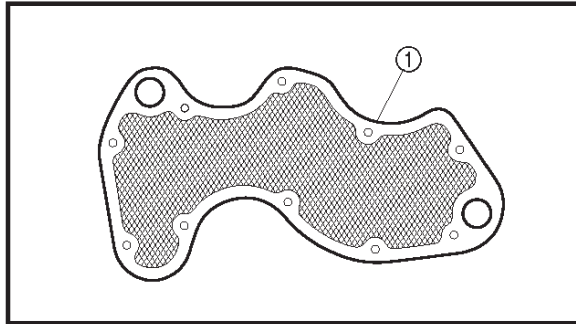


## Check valve inspection

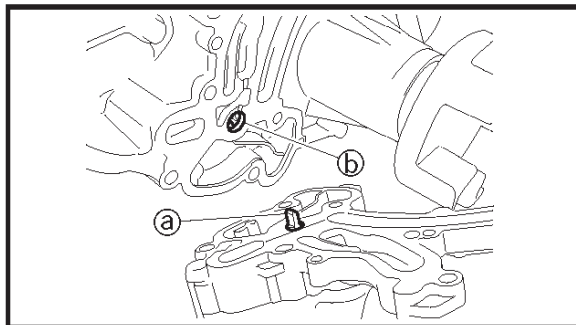
## 1. Check:

- Check valve seat (1)
- Check valve body (2)
- Check valve (3)
- Spring (4)

Damage/wear → Replace the defective part(s).

**OIL PUMP (Cont'd.)****Oil strainer inspection**

1. Check:
  - Oil strainer ①  
Damage → Replace.  
Contaminants → Clean.

**Oil pump installation**

1. Install:
  - Oil pump assembly

**NOTE:**

Align the projection ① on the oil pump shaft with the slit ② on the oil pump driven gear shaft.

**Oil pump assembly bolt:****M6:**

10 N • m (1.0 kgf • m, 7.2 ft • lb)  
LOCTITE 572

**M8:****1st:**

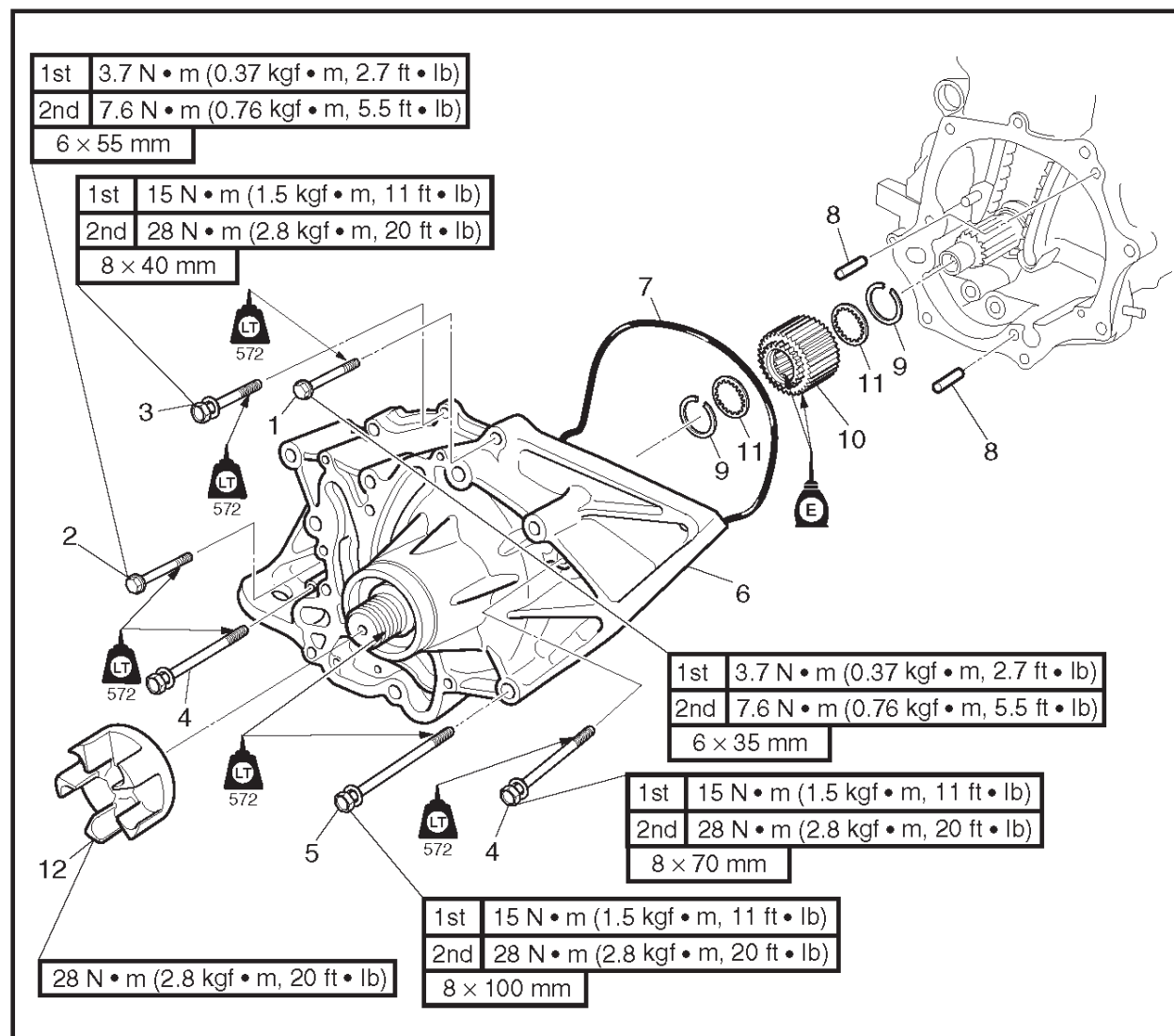
15 N • m  
(1.5 kgf • m, 11 ft • lb)

**2nd:**

28 N • m  
(2.8 kgf • m, 20 ft • lb)  
LOCTITE 572



## REDUCTION DRIVE GEAR EXPLODED DIAGRAM

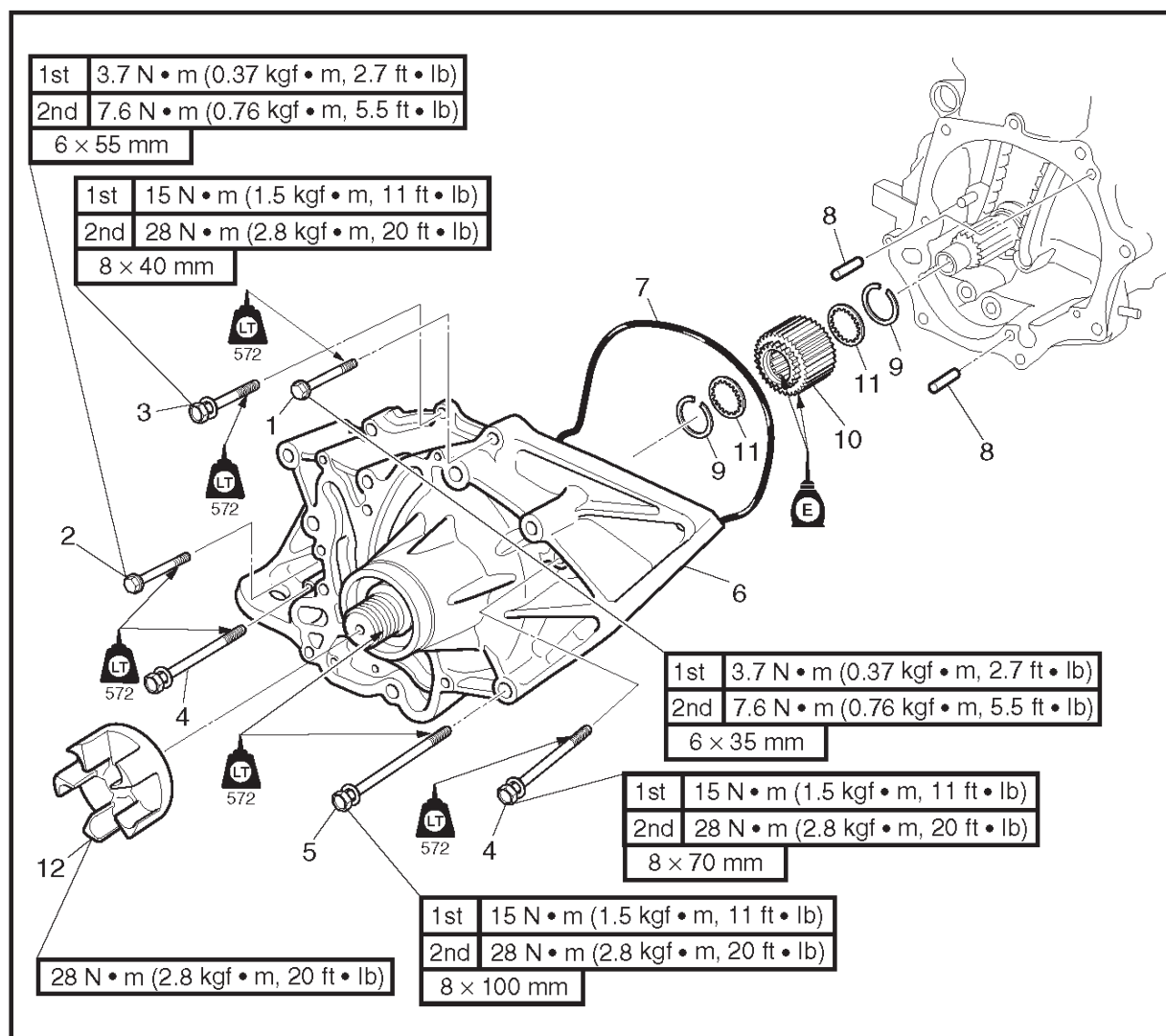


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>REDUCTION DRIVE GEAR REMOVAL</b>		Follow the left "Step" for removal.
	Generator cover		Refer to "GENERATOR AND STARTER MOTOR".
	Oil pump		Refer to "OIL PUMP".
1	Bolt	1	
2	Bolt	1	
3	Bolt	1	
4	Bolt	3	
5	Bolt	1	



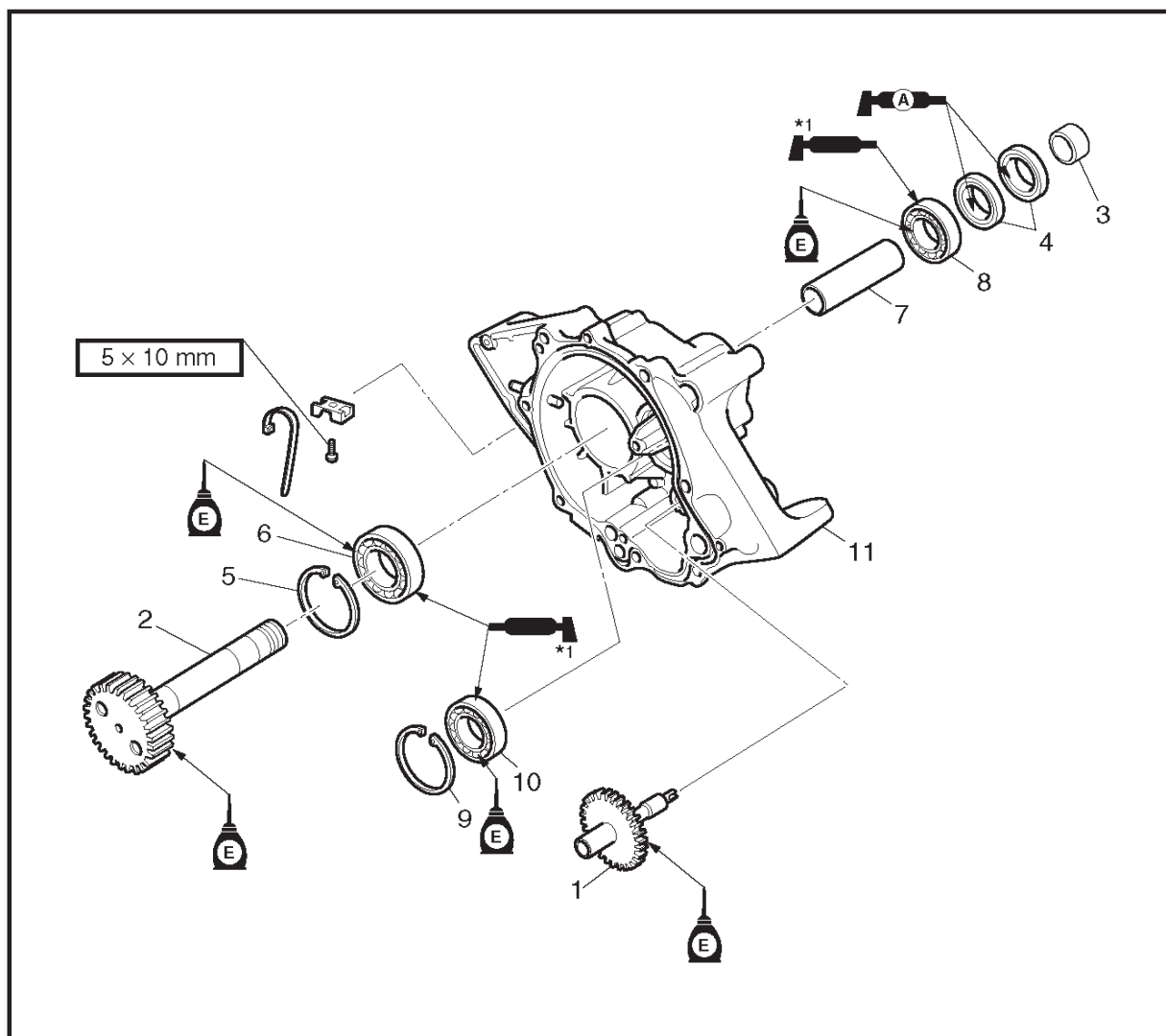
# REDUCTION DRIVE GEAR (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
6	Reduction drive gear case assembly	1	
7	Gasket	1	<b>Not reusable</b>
8	Pin	2	
9	Circlip	2	<b>Not reusable</b>
10	Reduction drive gear	1	
11	Washer	2	
12	Drive coupling	1	
Reverse the removal steps for installation.			



## REDUCTION DRIVE GEAR (Cont'd.) EXPLODED DIAGRAM



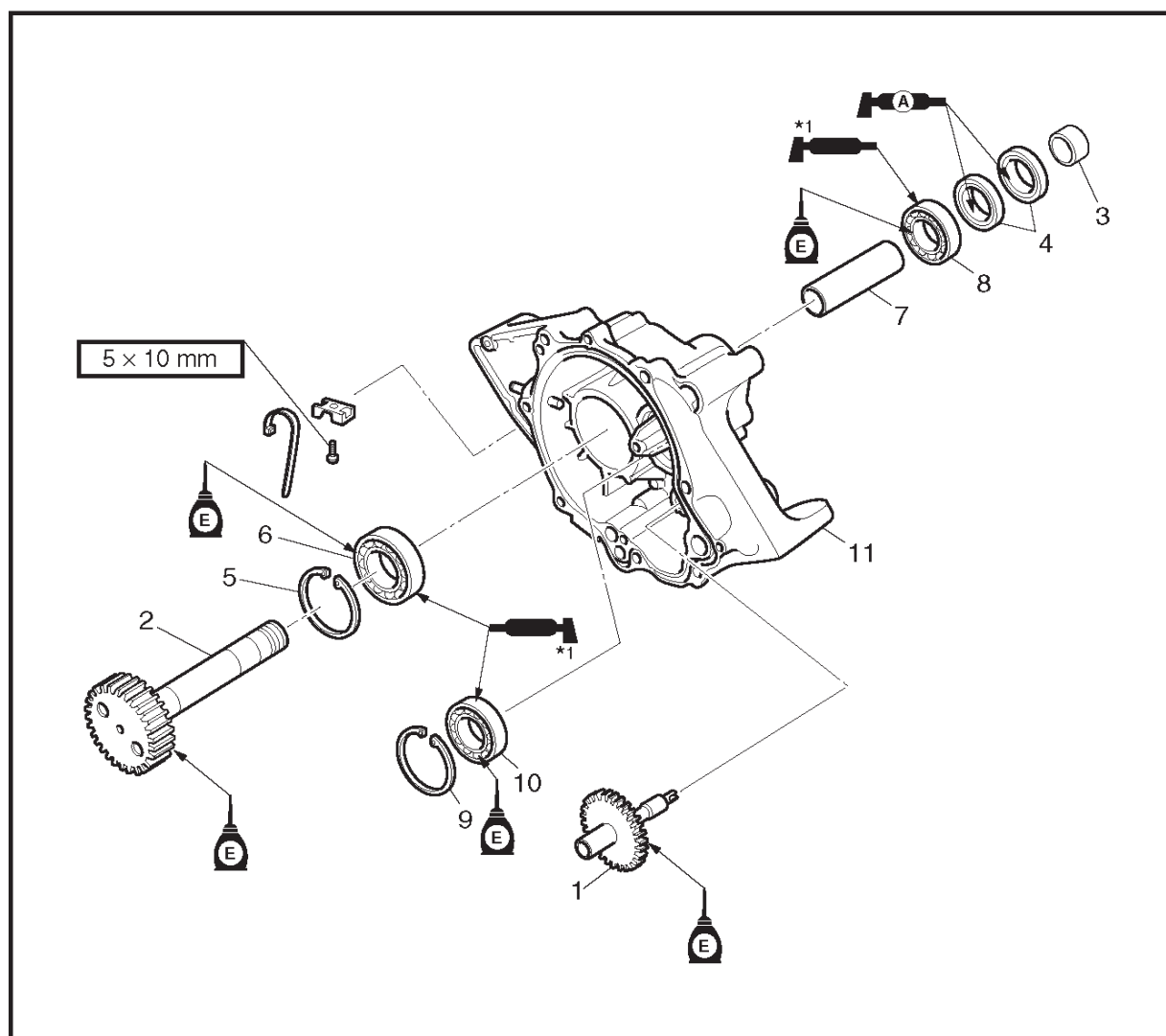
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>REDUCTION DRIVE GEAR DISASSEMBLY</b>		Follow the left "Step" for disassembly.
1	Oil pump drive shaft	1	
2	Drive shaft	1	
3	Collar	1	
4	Oil seal	2	<b>Not reusable</b>
5	Circlip	1	<b>Not reusable</b>
6	Bearing	1	<b>Not reusable</b>
7	Collar	1	
8	Bearing	1	<b>Not reusable</b>

\*1: EPNOC grease AP #0



# REDUCTION DRIVE GEAR (Cont'd.) EXPLODED DIAGRAM



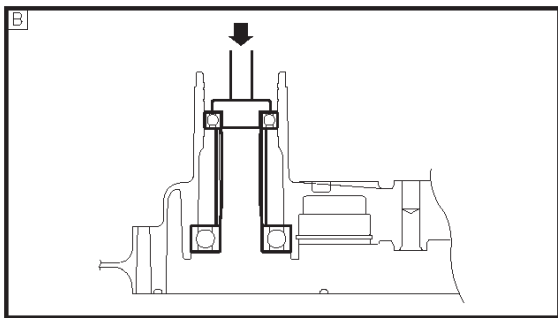
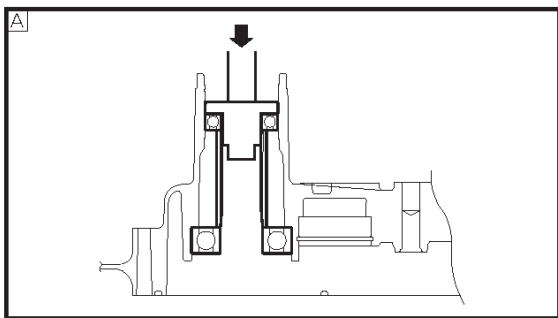
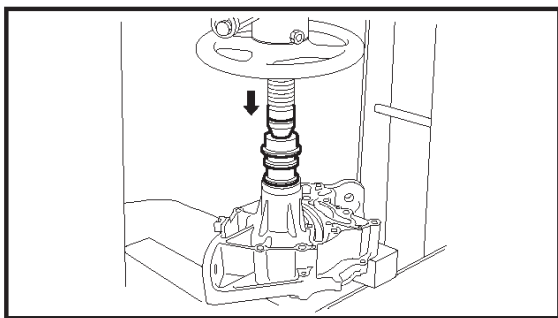
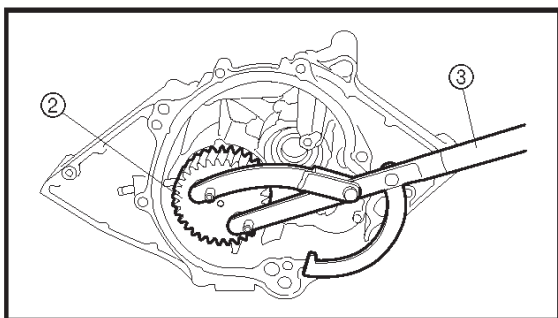
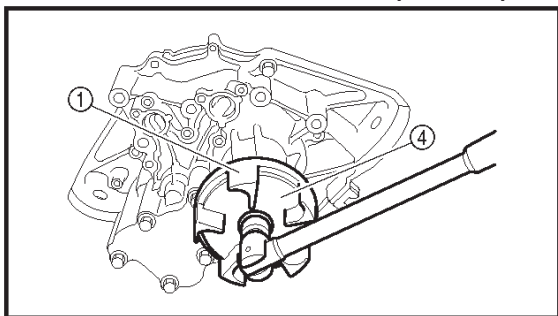
Step	Procedure/Part name	Q'ty	Service points
9	Circlip	1	<b>Not reusable</b>
10	Bearing	1	<b>Not reusable</b>
11	Reduction drive gear case	1	Reverse the disassembly steps for assembly.

\*1: EPNOC grease AP #0





## REDUCTION DRIVE GEAR (Cont'd.)



## SERVICE POINTS

## Drive coupling removal

1. Remove:
  - Reduction drive gear housing
2. Remove:
  - Drive coupling ①

**NOTE:**

While holding the drive shaft ② with the rotor holder ③, loosen the drive coupling with the coupler wrench ④.



**Coupler wrench:**  
YW-06551/90890-06551  
**Universal magneto and rotor holder:**  
YU-01235  
**Rotor holder:**  
90890-01235

## Drive shaft removal

1. Remove:
  - Drive shaft

**NOTE:**

Press in the direction of the arrow.

## Bearing removal

1. Remove:
  - Circlip
  - Rear bearing
  - Collar
  - Front bearing

**NOTE:**

Remove the front bearing, spacer, and rear bearing using a press.



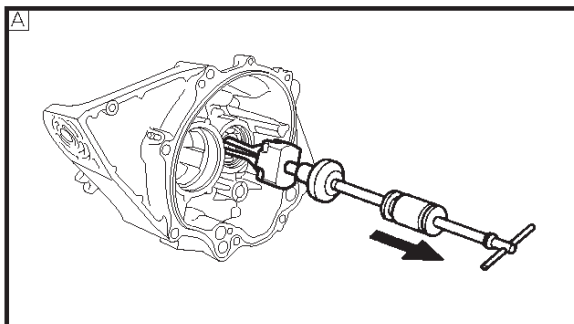
**Driver handle—large:**  
YB-06071  
**Driver rod L3:**  
90890-06652  
**Bearing housing needle bearing installer:**  
YB-06111  
**Needle bearing attachment:**  
90890-06653

**A** For USA and Canada

**B** For worldwide



## REDUCTION DRIVE GEAR (Cont'd.)



## 2. Remove:

- Circlip
- Reduction drive gear bearing

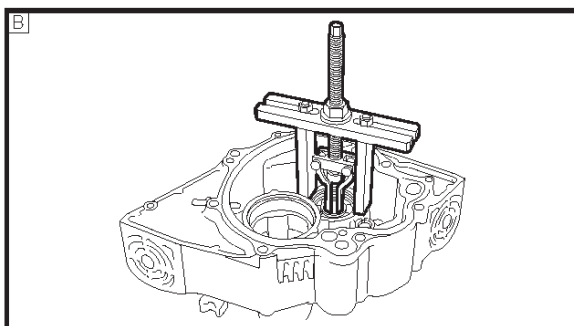


**Slide hammer and adapters:**  
YB-06096

**Stopper guide plate:**  
90890-06501

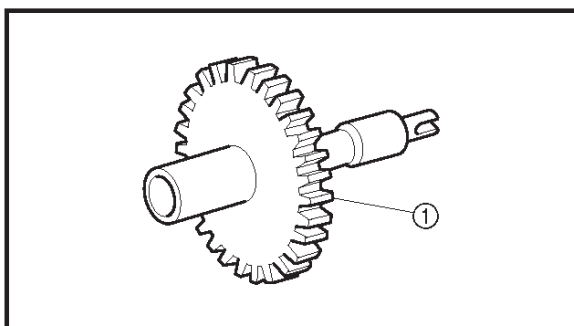
**Bearing puller assembly:**  
90890-06535

**Stopper guide stand:**  
90890-06538



**A** For USA and Canada

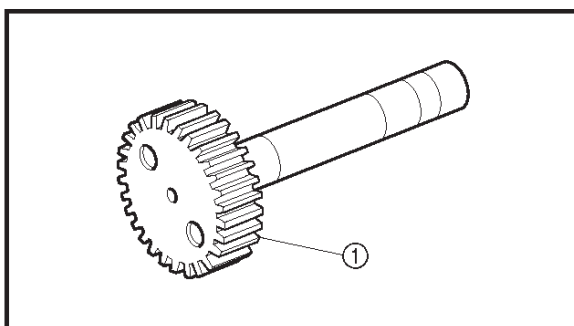
**B** For worldwide



## Oil pump driven gear inspection

## 1. Check:

- Oil pump drive shaft ①  
Cracks/damage/wear → Replace.



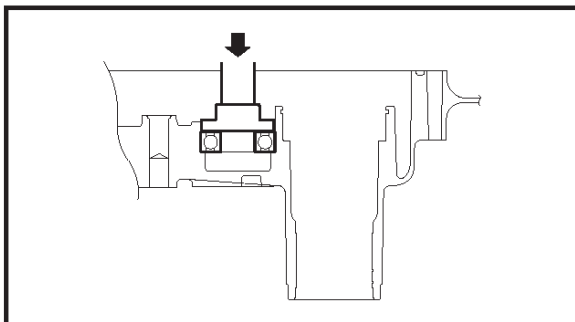
## Drive shaft inspection

## 1. Check:

- Drive shaft ①  
Cracks/damage/wear → Replace.



## REDUCTION DRIVE GEAR (Cont'd.)

**Bearing installing**

## 1. Install:

- Reduction drive gear bearing

**NOTE:**

Install the reduction driver gear bearing using a press.



**Driver handle—large:**

**YB-06071**

**Driver rod LS:**

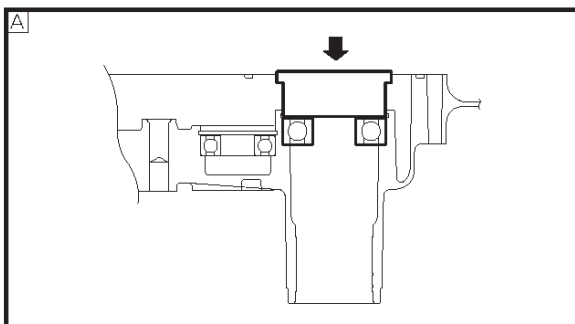
**90890-06606**

**Outer race installer—forward gear:**

**YB-06085**

**Ball bearing attachment:**

**90890-06631**



## 2. Install:

- Front bearing

**NOTE:**

Install the front bearing using a press.



**Driver rod LS:**

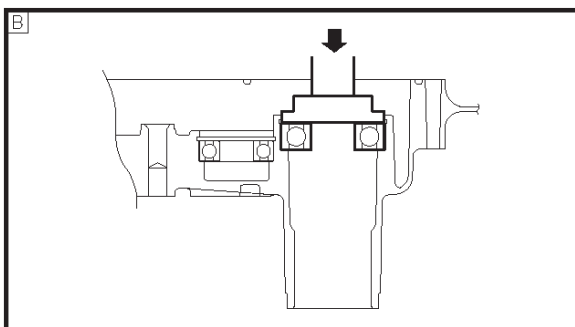
**90890-06606**

**Forward gear bearing cup installer:**

**YB-06726-B**

**Ball bearing attachment:**

**90890-06657**

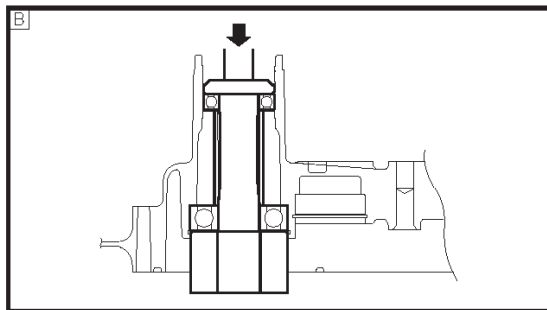
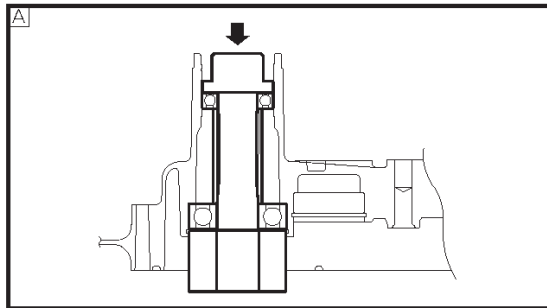


**A** For USA and Canada

**B** For worldwide



## REDUCTION DRIVE GEAR (Cont'd.)



## 3. Install:

- Collar
- Rear bearing

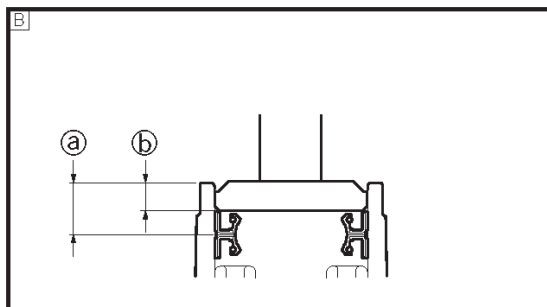
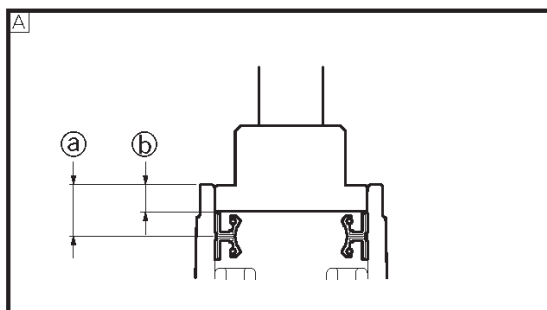
**NOTE:**

- Install the front bearing using a press.
- Before installing the rear bearing, hold both the inner and outer races of the front bearing in place as shown with a pipe that is at least 40 mm (1.57 in) long and has an outer diameter of 70 mm (2.76 in) and an inner diameter of 30 mm (1.18 in).

**Driver rod LS:****90890-06606****Outer race installer—forward gear:****YB-06085****Bearing outer race attachment:**  
**90890-06624**

[A] For USA and Canada

[B] For worldwide



## 4. Install:

- Oil seals

**Driver handle—large:****YB-06071****Driver rod LS:****90890-06606****Outer race installer—forward gear:****YB-06085****Bearing outer race attachment:**  
**90890-06624**

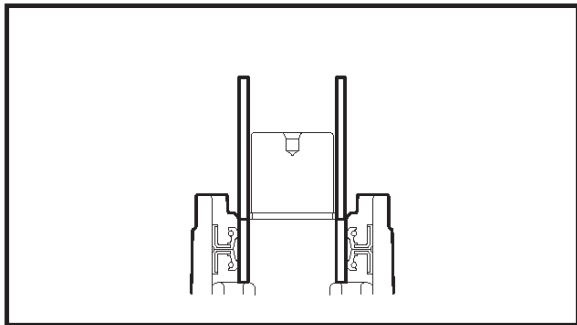
[A] For USA and Canada

[B] For worldwide

**Distance a:** **$17.9 \pm 0.2$  mm ( $0.70 \pm 0.01$  in)****Distance b:** **$9.3 \pm 0.2$  mm ( $0.37 \pm 0.01$  in)**



## REDUCTION DRIVE GEAR (Cont'd.)

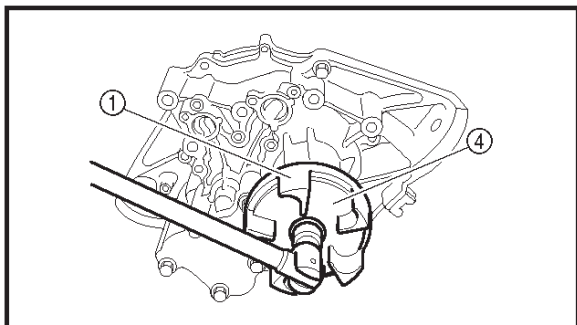


### Drive shaft installation

1. Install:
  - Drive shaft
  - Collar

### NOTE:

Press the into the reduction drive gear case with a pipe that is more than 30 mm (1.18 in) long, and which has an outer diameter of approximately 35 mm (1.97 in) and an inner diameter of approximately  $28 \pm 0.5$  mm ( $1.10 \pm 0.02$  in).

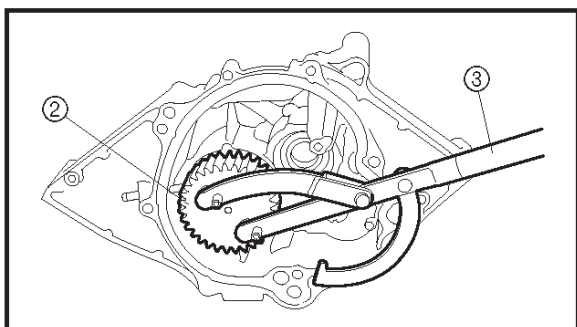


### Drive coupling installation

1. Install:
  - Drive coupling ①

### NOTE:

While holding the drive shaft ② with the rotor holder ③, tighten the drive coupling with the coupler wrench ④.



**Coupler wrench:**

**YW-06551/90890-06551**

**Universal magneto and rotor holder:**

**YU-01235**

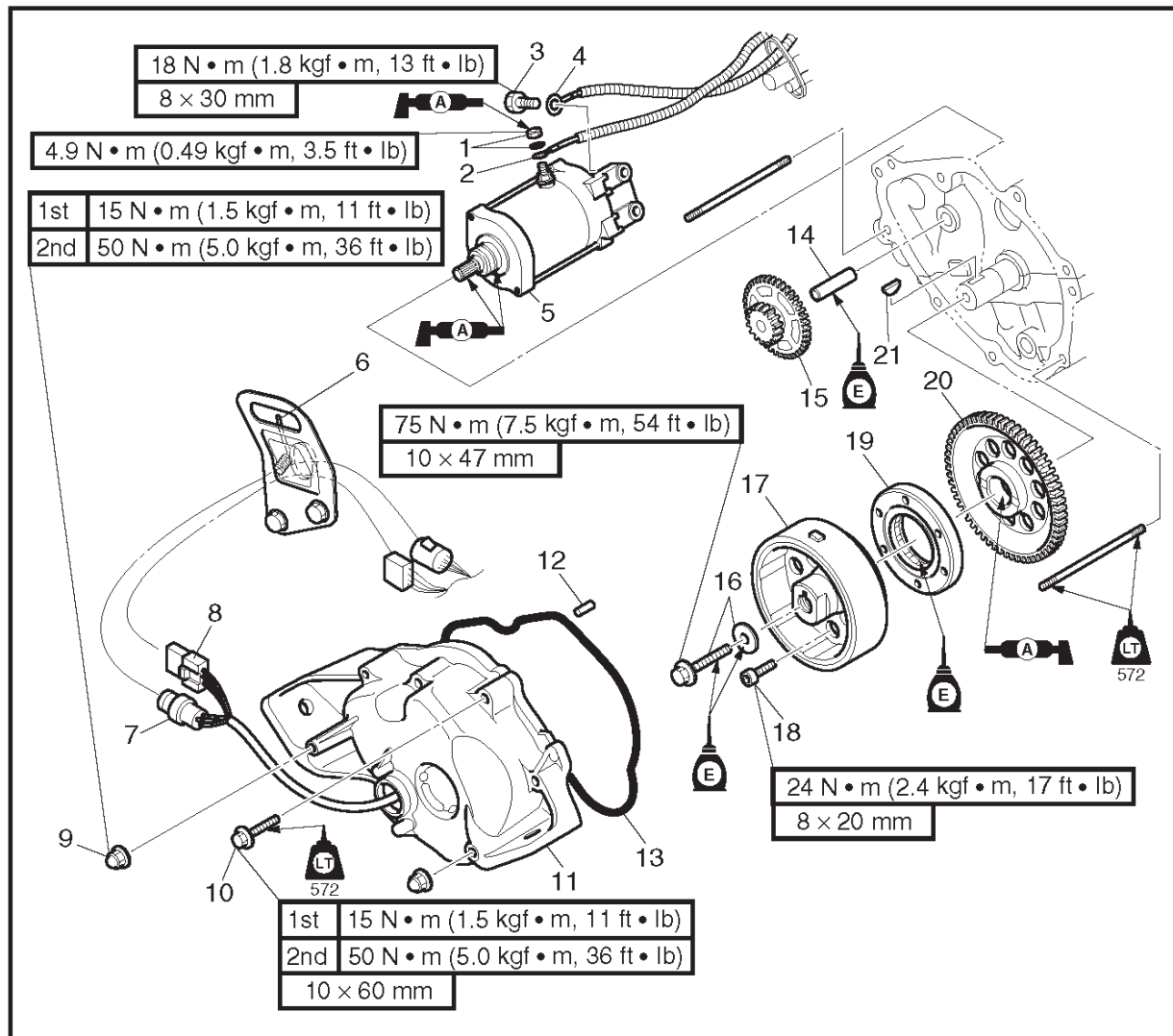
**Rotor holder:**

**90890-01235**

2. Install:
  - Reduction drive gear housing



## GENERATOR AND STARTER MOTOR EXPLODED DIAGRAM

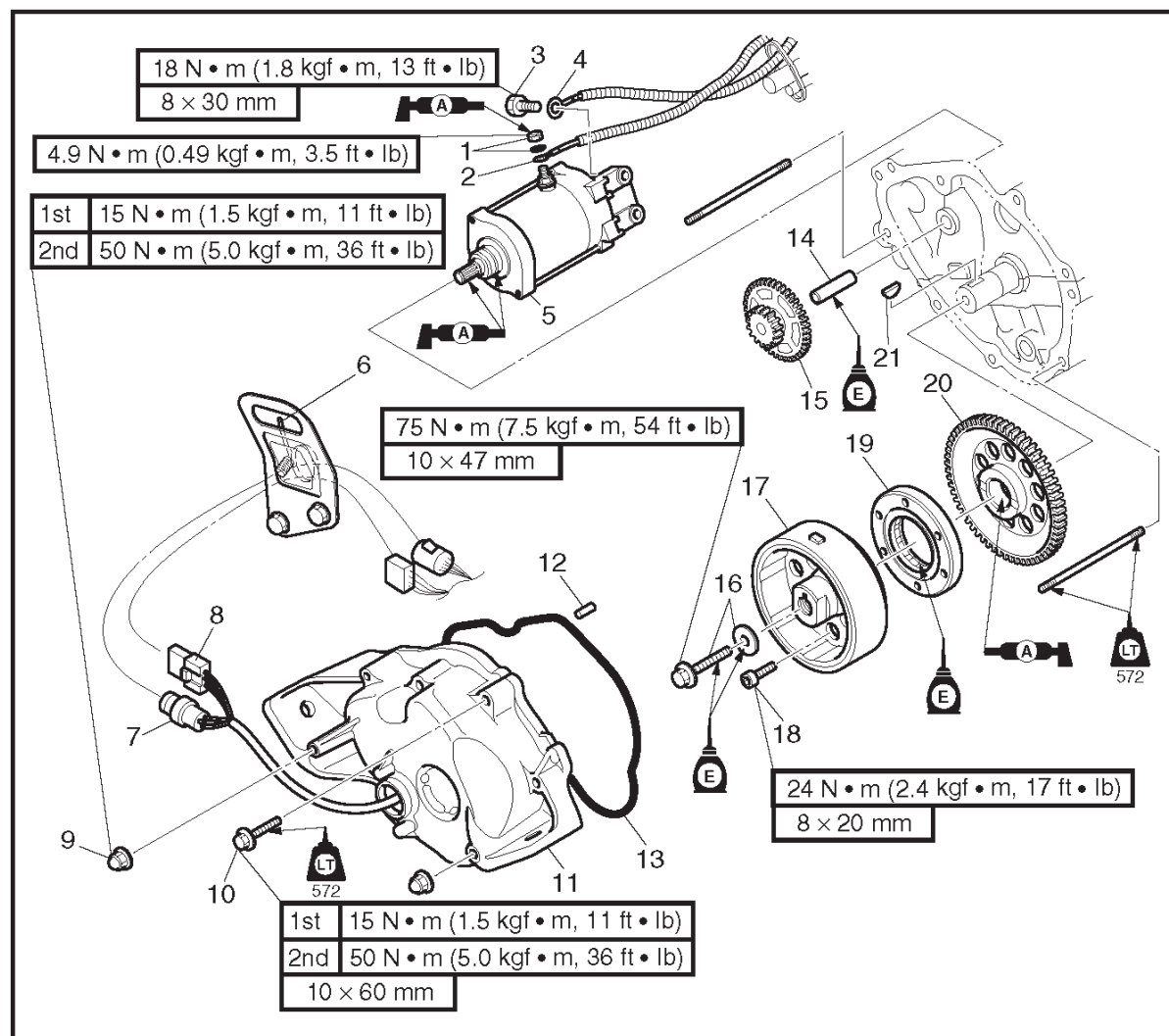


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>GENERATOR COVER AND FLYWHEEL MAGNETO REMOVAL</b>		Follow the left "Step" for removal.
	Engine unit		Refer to "ENGINE UNIT".
1	Nut/washer	1/1	
2	Starter motor lead	1	
3	Bolt	2	
4	Battery negative lead	1	
5	Starter motor	1	
6	Band	1	
7	Lighting coil coupler	1	



## GENERATOR AND STARTER MOTOR (Cont'd.) EXPLODED DIAGRAM

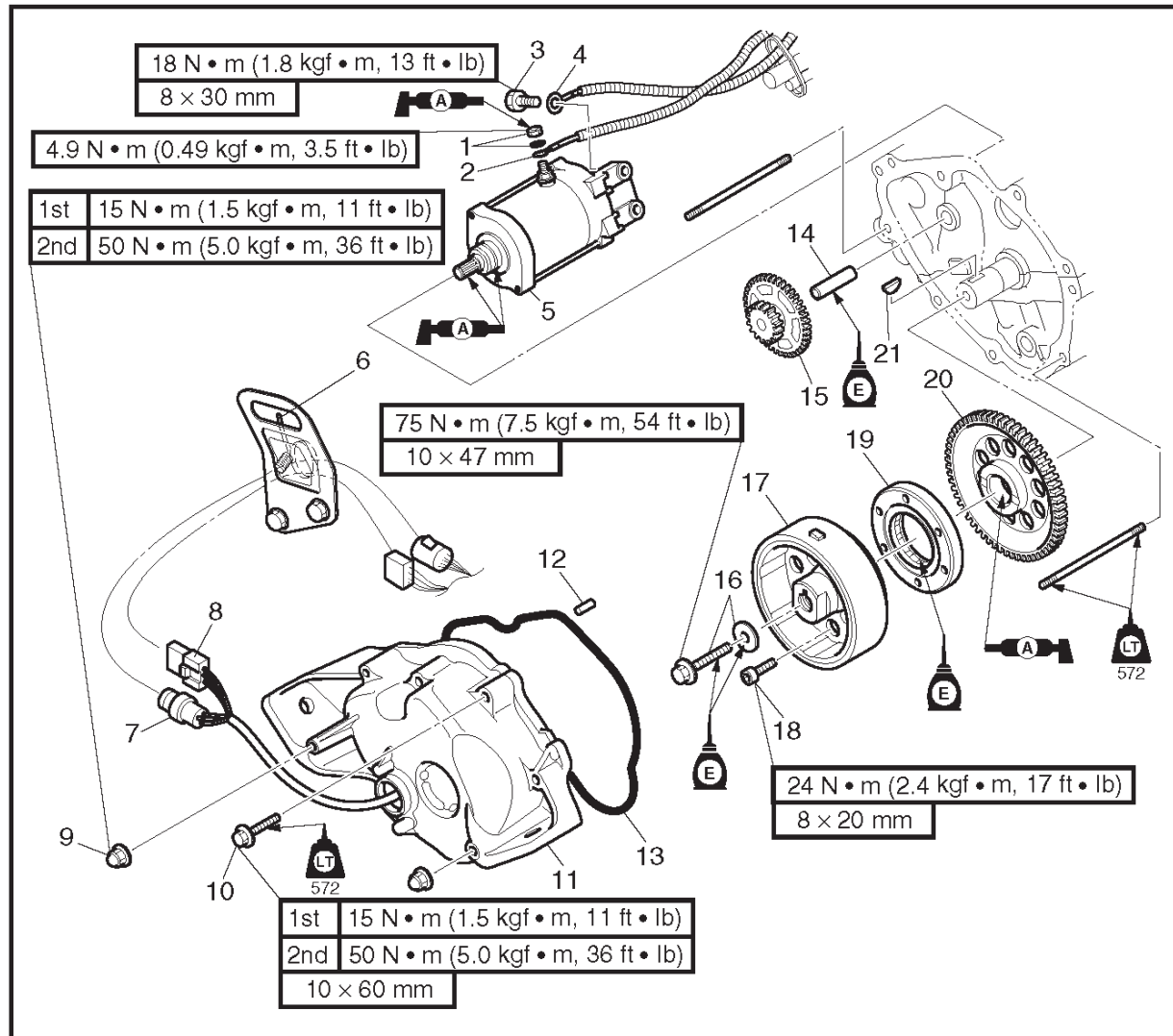


Step	Procedure/Part name	Q'ty	Service points
8	Pulser coil coupler	1	
9	Nut	2	
10	Bolt	8	
11	Generator cover	1	
12	Dowel pin	2	
13	Gasket	1	<b>Not reusable</b>
14	Idle gear shaft	1	
15	Idle gear	1	
16	Bolt/washer	1/1	<b>Not reusable</b>
17	Flywheel magneto	1	
18	Bolt	6	



## GENERATOR AND STARTER MOTOR (Cont'd.)

### EXPLODED DIAGRAM

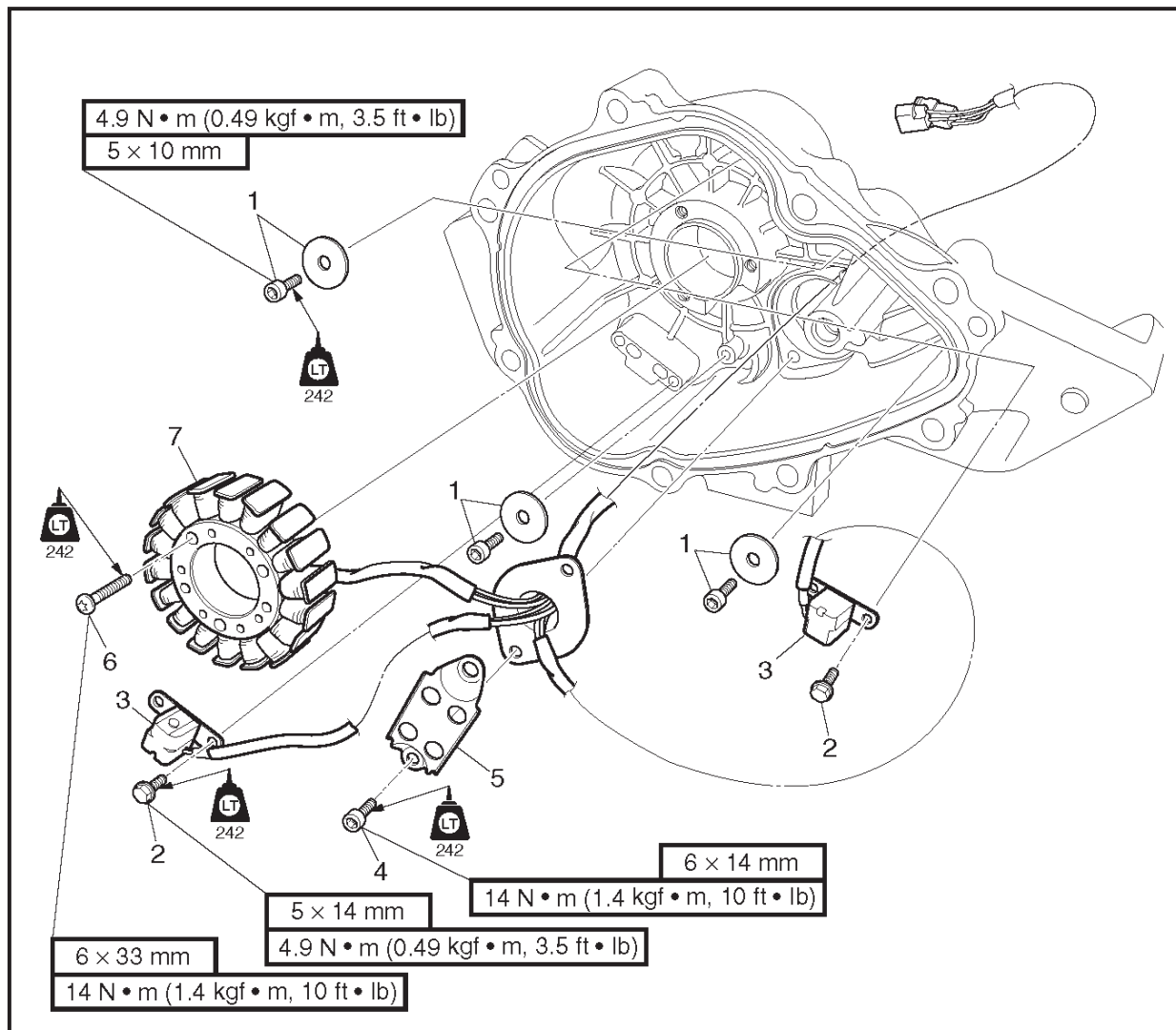


Step	Procedure/Part name	Q'ty	Service points
19	Starter clutch	1	Reverse the removal steps for installation.
20	Starter gear	1	
21	Woodruff key	1	





## GENERATOR AND STARTER MOTOR (Cont'd.) EXPLODED DIAGRAM

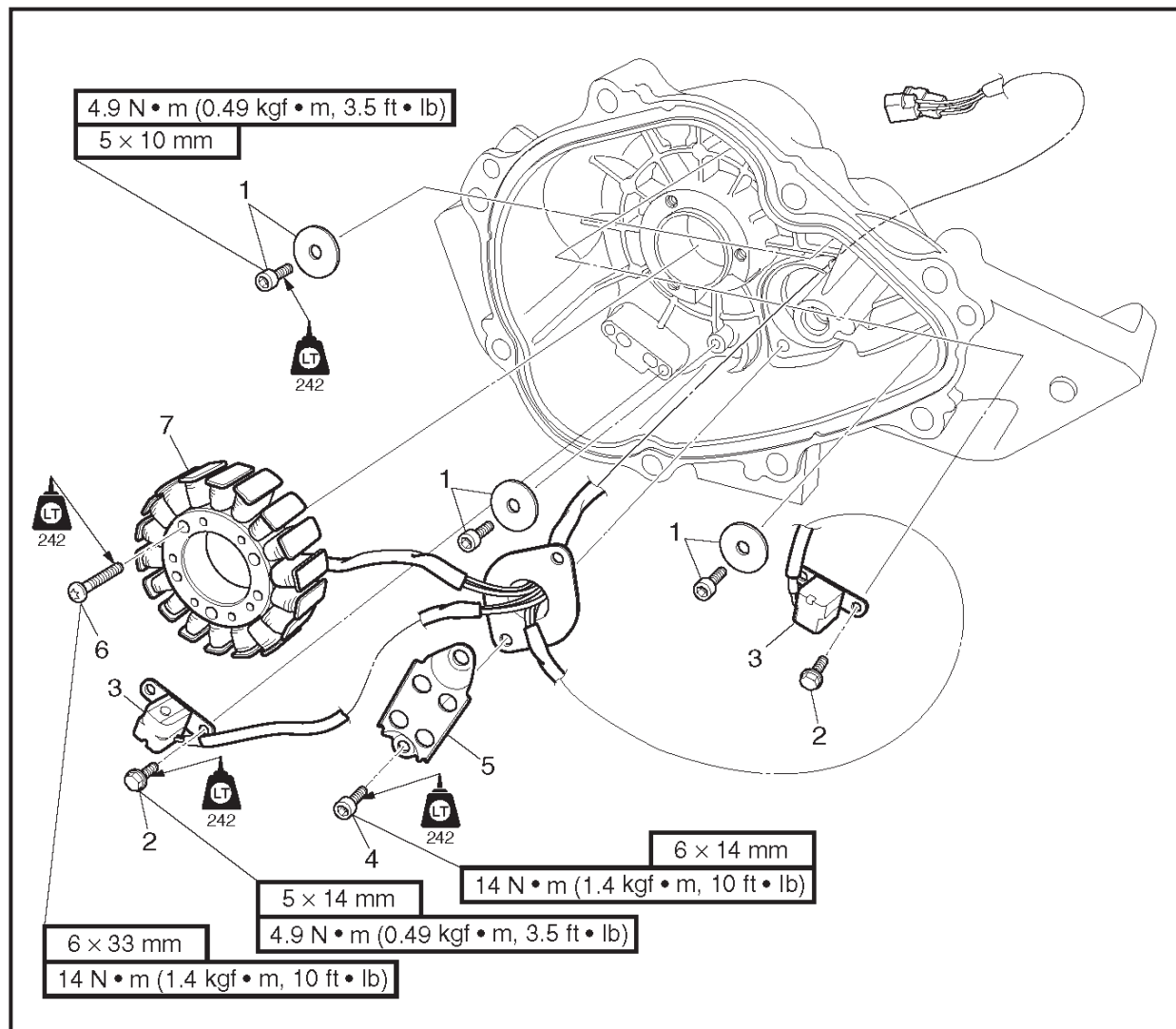


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>GENERATOR DISASSEMBLY</b>		Follow the left "Step" for disassembly.
1	Bolt/washer	3/3	<b>NOTE:</b> _____ There washers holds the pickup coil lead. Make sure to not pitch the lead between the projection and the washer when installing the bolt.
2	Bolt	4	
3	Pickup coil	2	
4	Bolt	2	



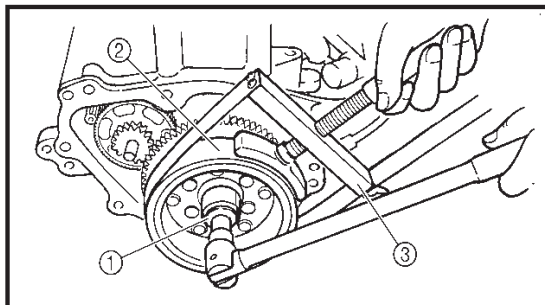
## GENERATOR AND STARTER MOTOR (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
5	Holder	1	Reverse the disassembly steps for assembly.
6	Bolt	3	
7	Lighting coil	1	



## GENERATOR AND STARTER MOTOR (Cont'd.)



### SERVICE POINTS

#### Flywheel magneto removal

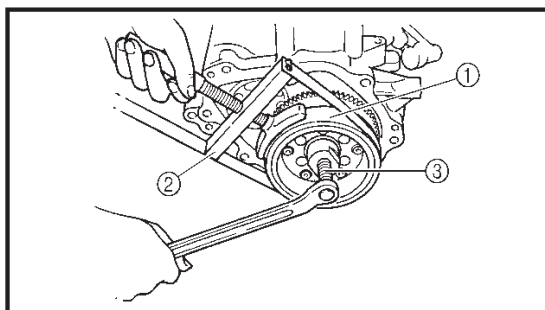
1. Remove:
  - Flywheel magneto bolt ①
  - Washer

#### NOTE:

While holding the flywheel magneto ② with the sheave holder ③, loosen the flywheel magneto bolt.



**Sheave holder:**  
YS-01880-A/90890-01701



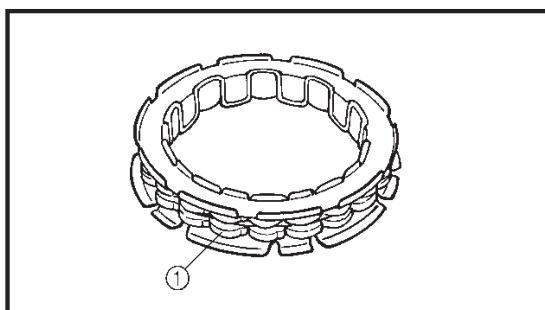
2. Remove:
  - Flywheel magneto ①
  - Woodruff key

#### NOTE:

While holding the flywheel magneto with sheave holder ②, remove the flywheel magneto with the rotor puller ③.



**Rotor puller:**  
YM-01082/90890-01080

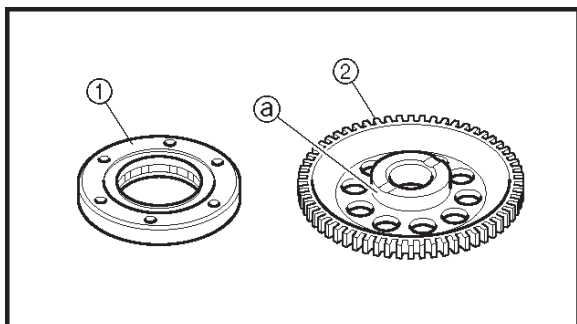


### Starter clutch inspection

1. Check:
  - Starter clutch rollers ①
 Damage/wear → Replace.



## GENERATOR AND STARTER MOTOR (Cont'd.)

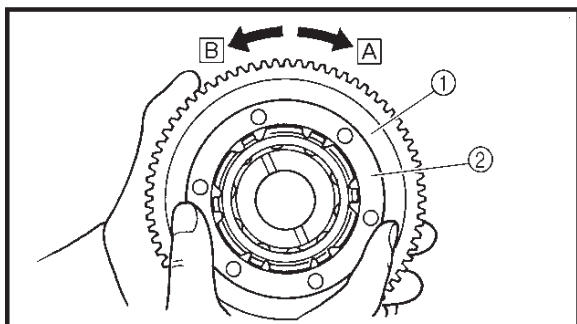


## 2. Check:

- Starter clutch ①
- Starter gear ②  
Burrs/chips/roughness/wear → Replace the defective part(s).

## 3. Check:

- Starter clutch gear's contacting surfaces ③  
Damage/pitting/wear → Replace the starter clutch gear.



## 4. Check:

- Starter clutch operation

**Checking steps:**

- Install the starter gear ① onto the starter clutch ② and hold the starter clutch.
- When turning the starter gear clockwise [A], it should turn freely, otherwise the starter clutch is faulty and must be replaced.
- When turning the starter gear counter-clockwise [B], the starter clutch and the starter gear should engage, otherwise the starter clutch is faulty and must be replaced.



## GENERATOR AND STARTER MOTOR (Cont'd.)

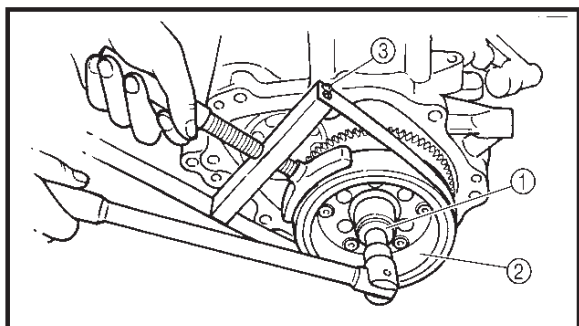
### Flywheel magneto installation

#### 1. Install:

- Woodruff key
- Flywheel magneto
- Washer
- Flywheel magneto bolt

#### NOTE:

- Clean the tapered portion of the crankshaft and the flywheel magneto hub.
- When installing the flywheel magneto, make sure the woodruff key is properly seated in the keyway of the crankshaft.
- Lubricate the flywheel magneto bolt and washer with engine oil.



#### 2. Tighten:

- Flywheel magneto bolt ①

#### NOTE:

While holding the flywheel magneto ② with the sheave holder ③, tighten the flywheel magneto bolt.



**Flywheel magneto bolt:**  
75 N • m (7.5 kgf • m, 54 ft • lb)



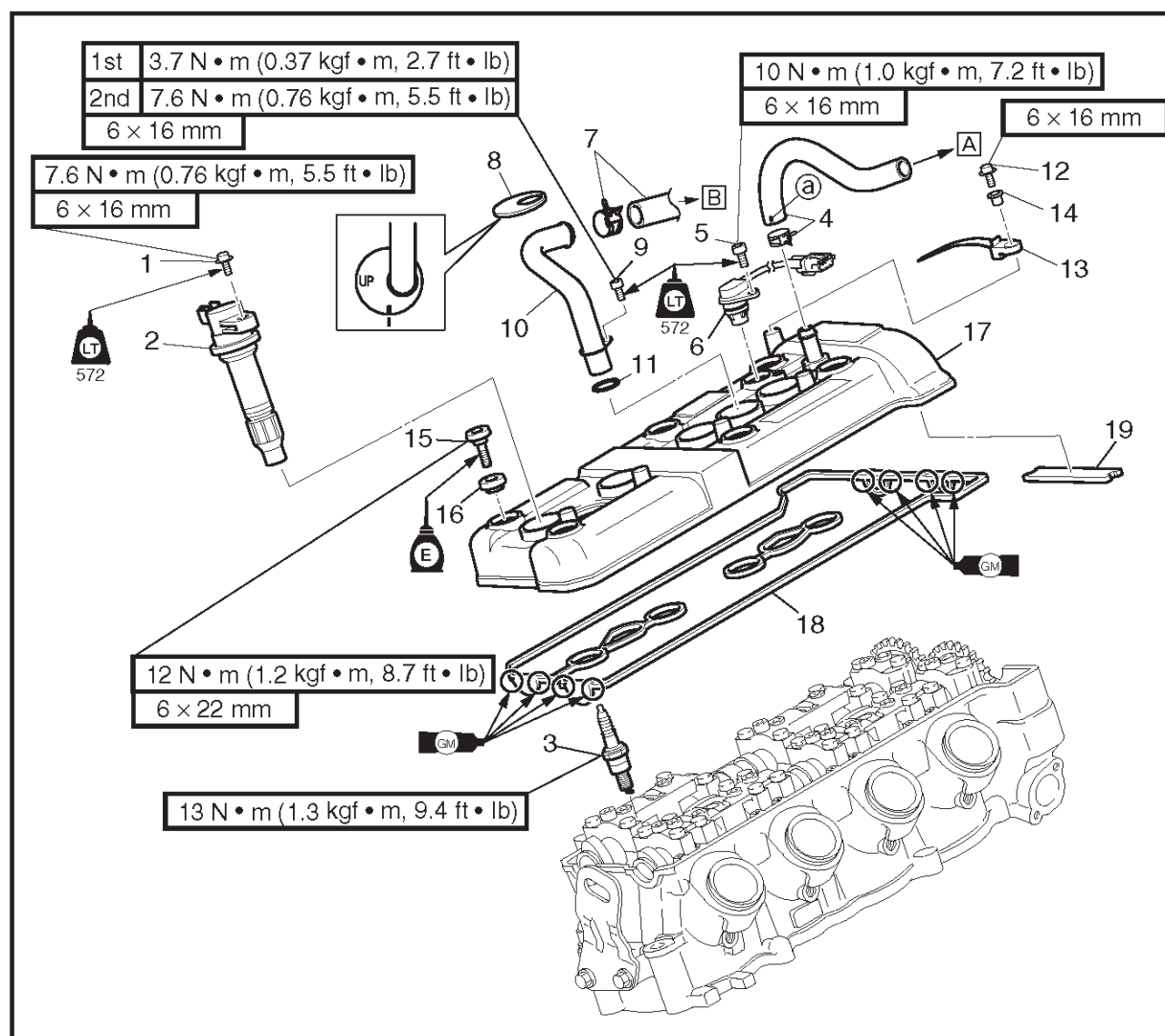
**Sheave holder:**  
YS-01880-A/90890-01701

#### CAUTION:

Do not reuse the flywheel magneto bolt and washer, always replace them with new ones.



## CAMSHAFTS EXPLODED DIAGRAM



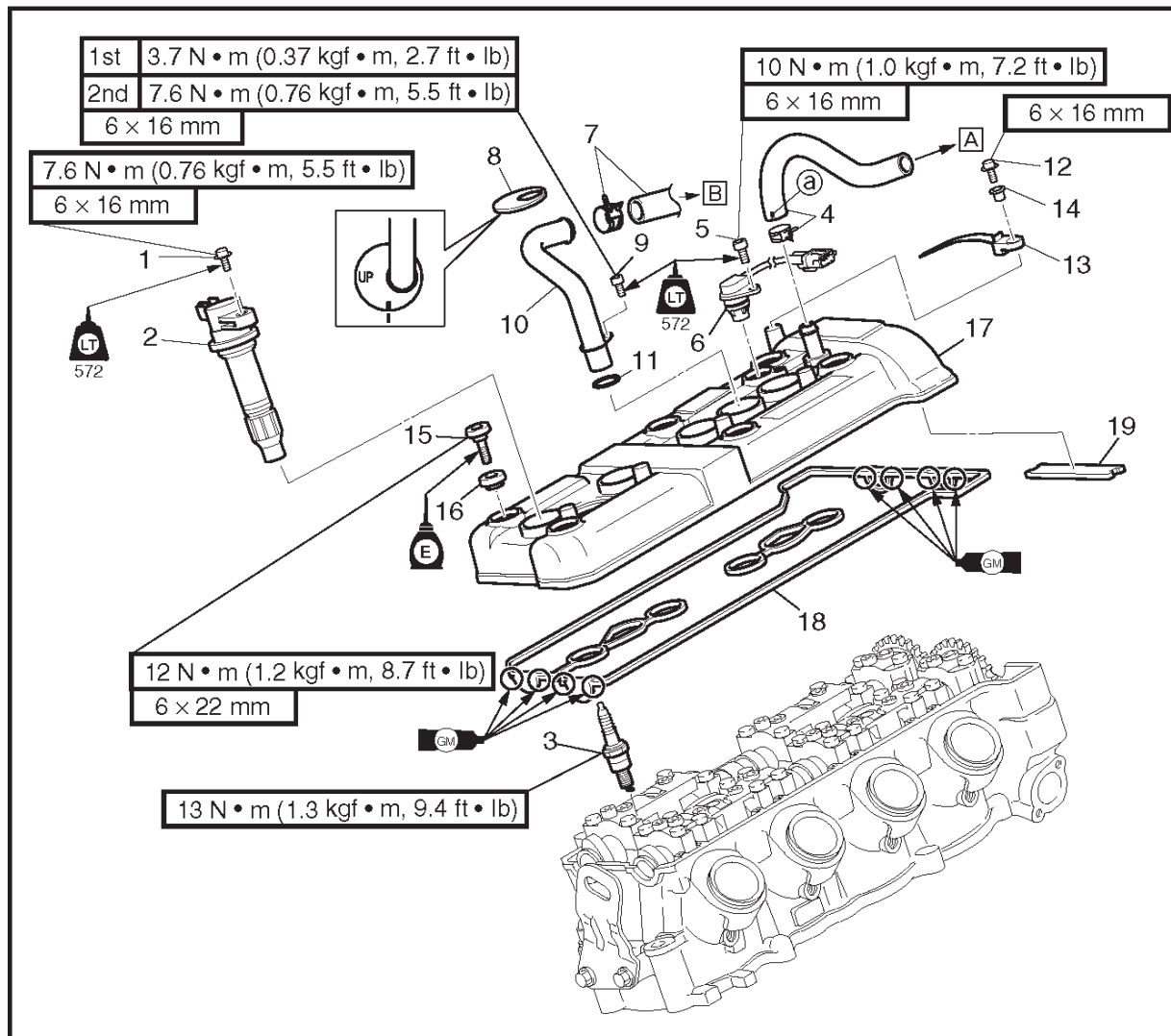
## REMOVAL AND INSTALLATION CHART


Step	Procedure/Part name	Q'ty	Service points
	<b>CYLINDER HEAD COVER REMOVAL</b>		Follow the left "Step" for removal.
	Air filter case		Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
1	Bolt	4	
2	Ignition coil	4	
3	Spark plug	4	
4	Clamp/breather hose	1/1	[A] To oil tank Paint mark @
5	Bolt	1	
6	Cam position sensor	1	



## CAMSHAFTS (Cont'd.)

## EXPLODED DIAGRAM

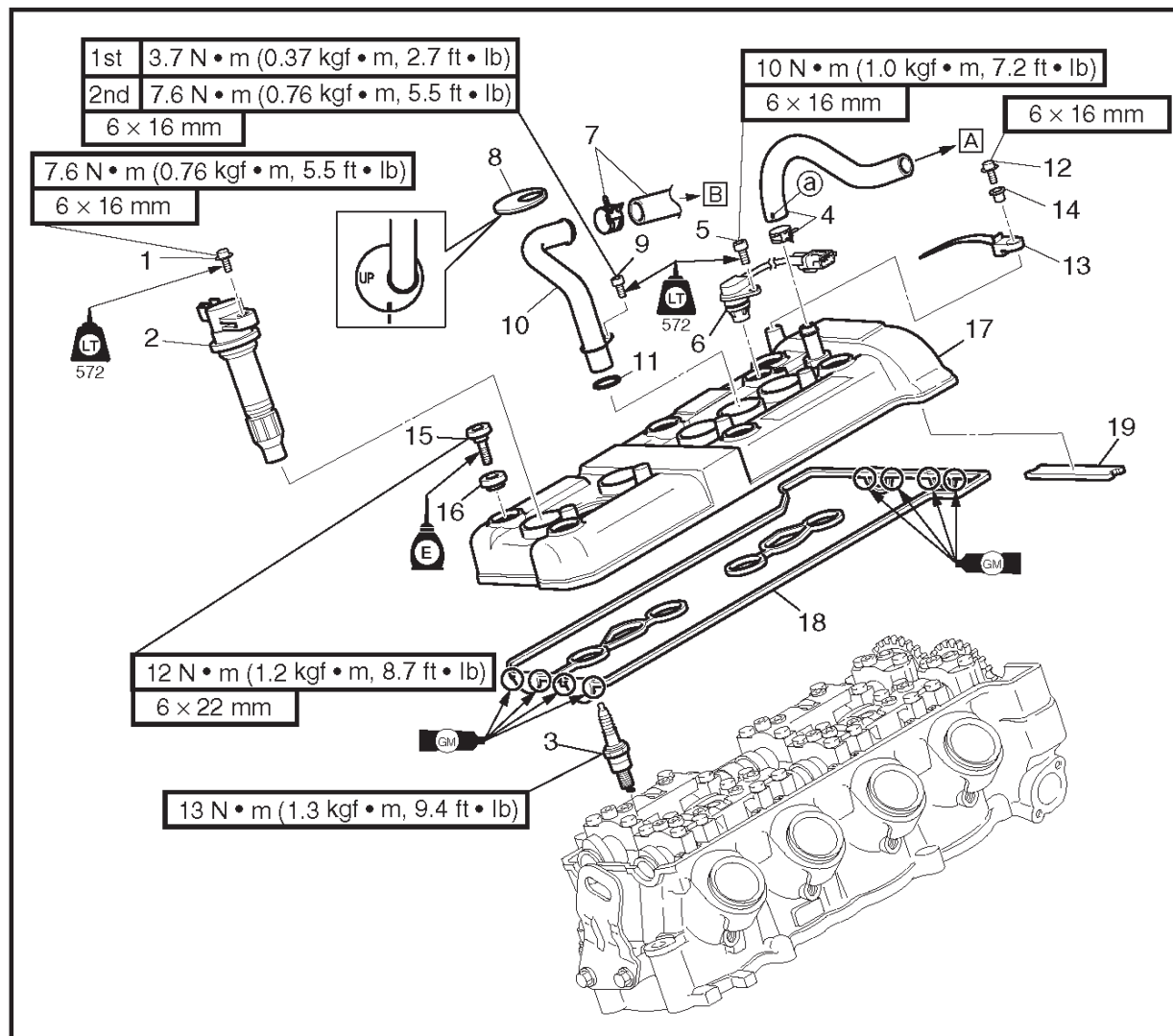


Step	Procedure/Part name	Q'ty	Service points
7	Clamp/cooling water hose	1/1	 To thermostat
8	Rubber seal	1	
9	Bolt	1	
10	Cooling water pipe	1	
11	O-ring	1	<b>Not reusable</b>
12	Bolt	1	
13	Band	1	
14	Collar	1	
15	Bolt	6	
16	Rubber mount	6	
17	Cylinder head cover	1	



## CAMSHAFTS (Cont'd.)

### EXPLODED DIAGRAM

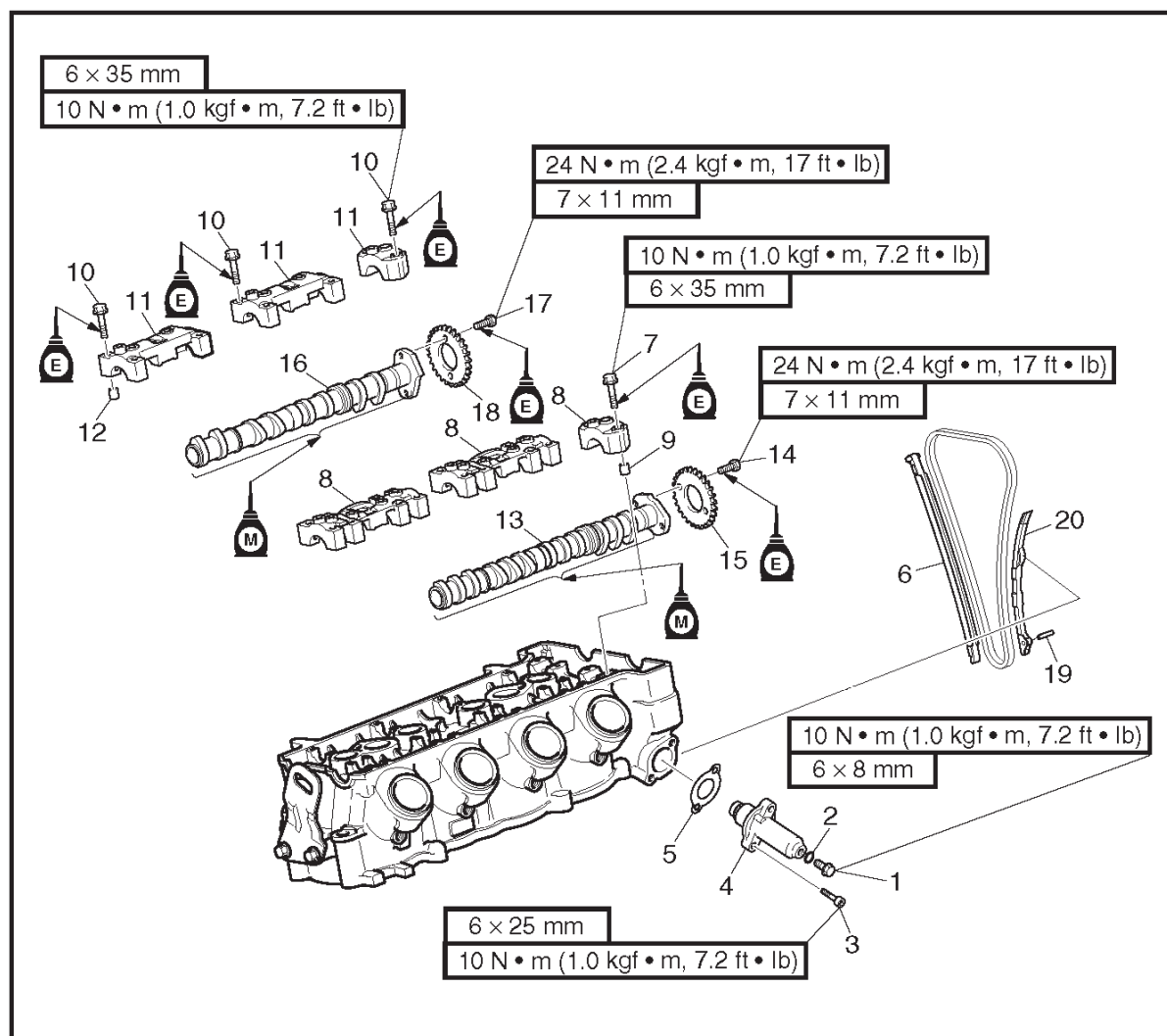


Step	Procedure/Part name	Q'ty	Service points
18	Cylinder head cover gasket	1	<b>Not reusable</b>
19	Timing chain guide (top side)	1	
Reverse the removal steps for installation.			





## CAMSHAFTS (Cont'd.) EXPLODED DIAGRAM

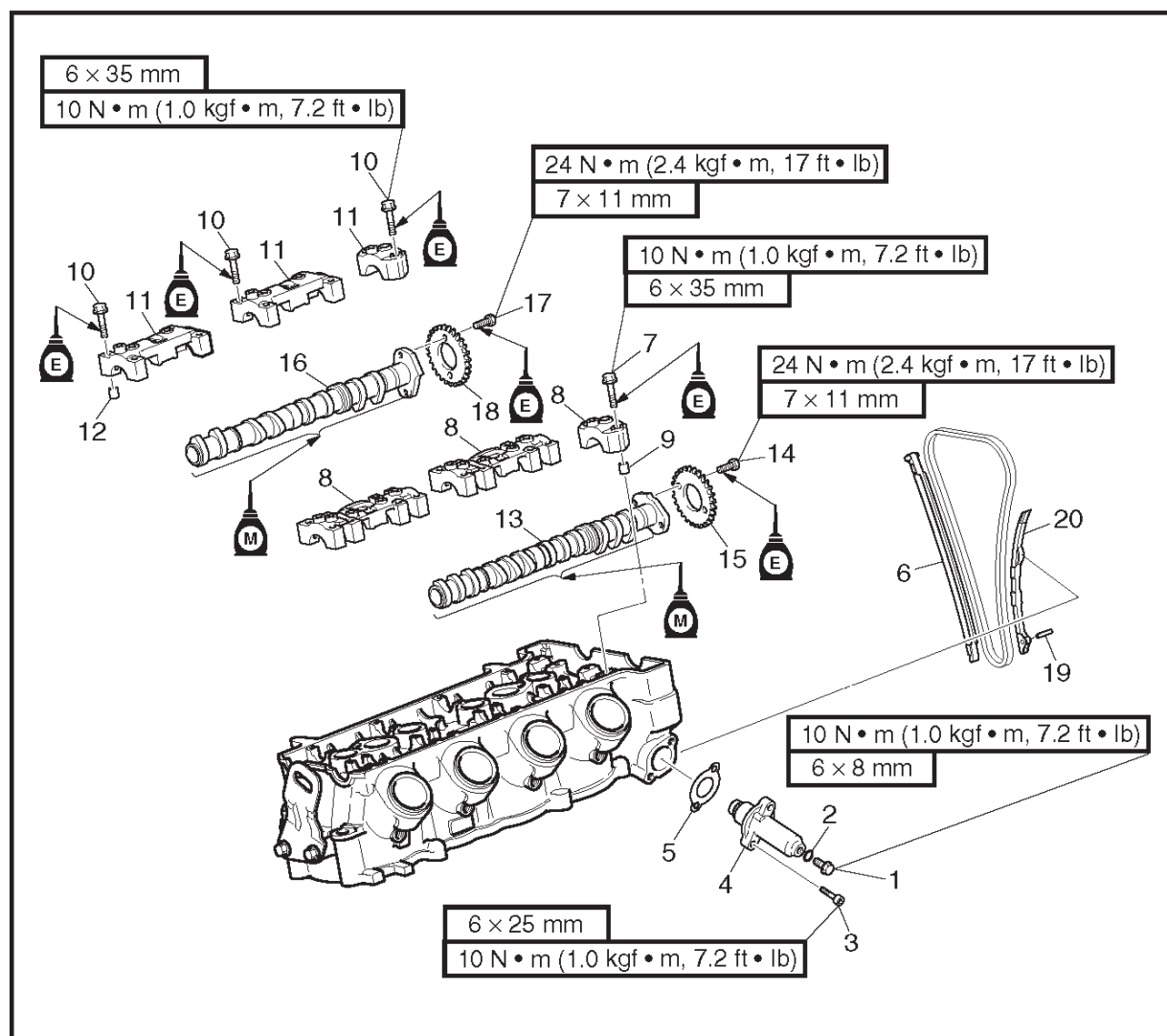


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>CAMSHAFT REMOVAL</b>		Follow the left "Step" for removal.
	Cylinder head cover		Refer to "REDUCTION DRIVE GEAR".
	Reduction drive gear case		<b>NOTE:</b> _____ When removing camshafts it is not necessary to remove the reduction drive gear case.
1	Cap bolt	1	<b>Not reusable</b>
2	Gasket	1	
3	Bolt	2	
4	Timing chain tensioner	1	



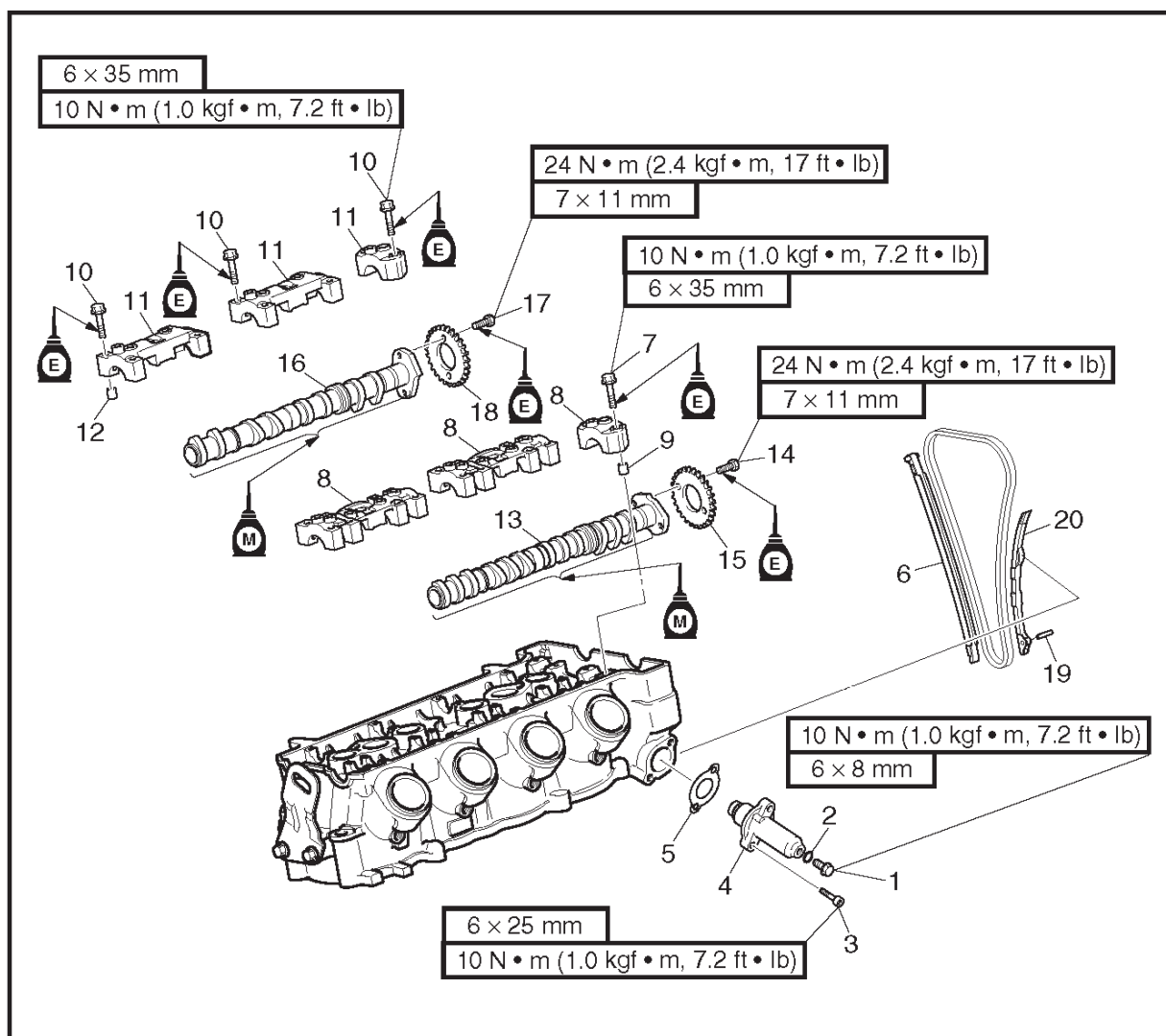
# CAMSHAFTS (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
5	Timing chain tensioner gasket	1	<b>Not reusable</b>
6	Timing chain guide (exhaust side)	1	
7	Bolt	18	<b>NOTE:</b> _____ During removal, the dowel pins may still be connected to the camshaft caps.
8	Intake camshaft cap	3	
9	Dowel pin	6	
10	Bolt	10	
11	Exhaust camshaft cap	3	
12	Dowel pin	6	
13	Intake camshaft	1	
14	Bolt	2	
15	Intake camshaft sprocket	1	



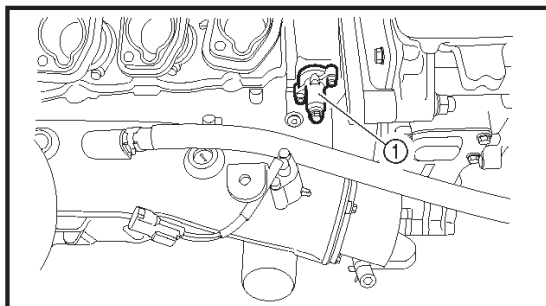
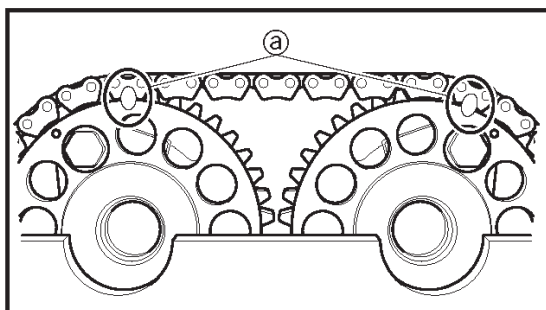
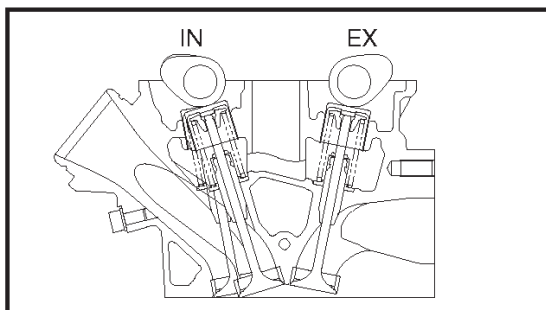
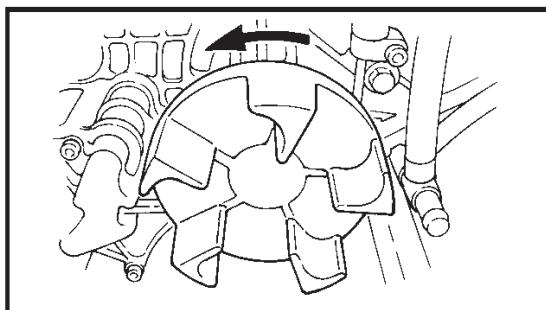
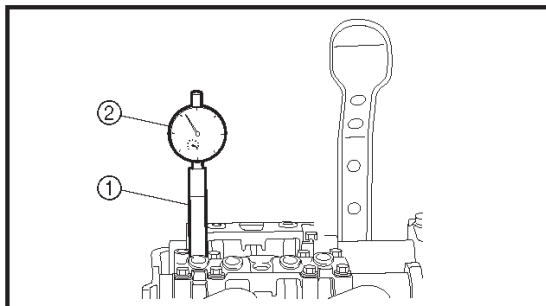
## CAMSHAFTS (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
16	Exhaust camshaft	1	Reverse the removal steps for installation.
17	Bolt	2	
18	Exhaust camshaft sprocket	1	
19	Pin	1	
20	Timing chain guide (intake side)	1	



## CAMSHAFTS (Cont'd.)



## SERVICE POINTS

## Camshaft removal

## 1. Install:

- Dial gauge needle
- Dial gauge stand ①  
(into spark plug hole #1)
- Dial gauge ②



**Dial gauge stand:**  
90890-06583

**Dial gauge needle:**  
90890-06584

**Dial gauge stand set:**  
YW-06585/90890-06585

**Dial gauge:**  
YU-03097/90890-01252

2. Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.

**NOTE:**

TDC on the compression stroke can be found when the camshaft lobes are turned away from each other.

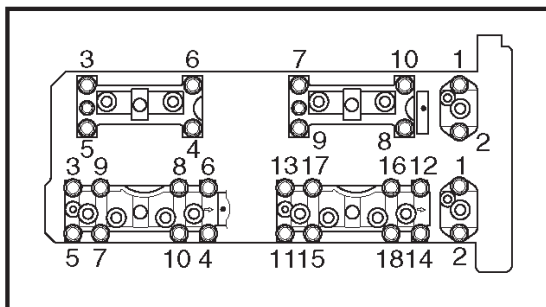
3. Make the alignment marks (a) on the timing chain and camshaft sprockets.

## 4. Remove:

- Timing chain tensioner ①
- Gasket



## CAMSHAFTS (Cont'd.)

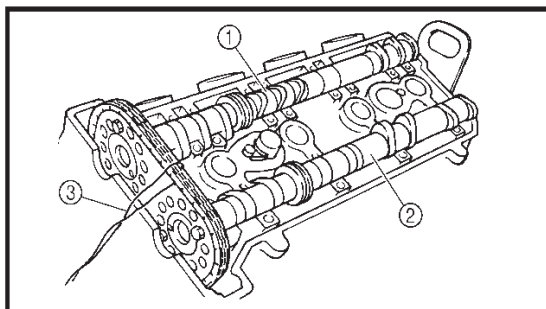


## 5. Remove:

- Camshaft caps
- Dowel pins

**NOTE:**

Loosen the intake and exhaust camshaft cap bolts in the sequence shown.

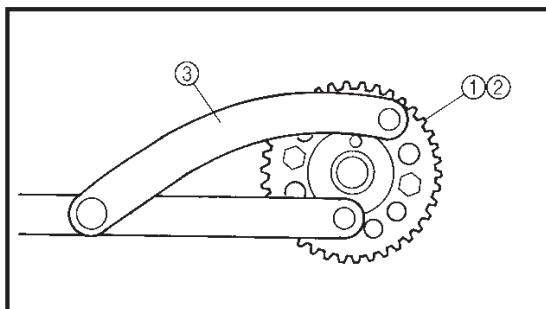


## 6. Remove:

- Intake camshaft ①
- Exhaust camshaft ②

**NOTE:**

To prevent the timing chain from falling into the crankcase, fasten it with a wire ③.



## 7. Remove:

- Exhaust camshaft sprocket ①
- Intake camshaft sprocket ②  
(with the special tool ③)



**Universal magneto and rotor holder:**

**YU-01235**

**Rotor holder:**  
**90890-01235**

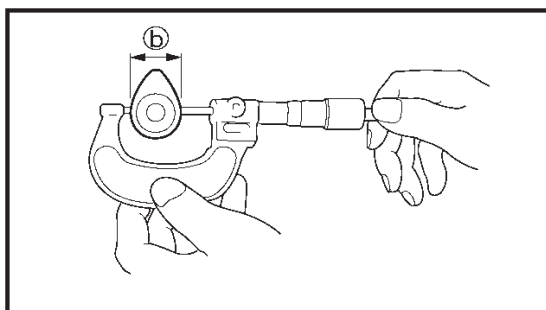
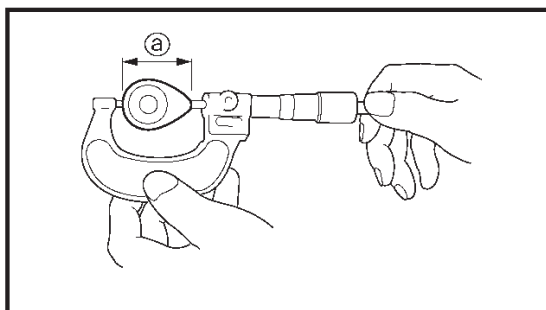
**Camshaft inspection**

## 1. Check:

- Camshaft lobes  
Blue discoloration/pitting/scratches → Replace the camshaft.

## 2. Measure:

- Camshaft lobe dimensions ① and ②  
Out of specification → Replace the camshaft.



**Cam lobe dimensions:**

**Intake camshaft:**

① 32.55 mm (1.281 in)

② 25.00 mm (0.984 in)

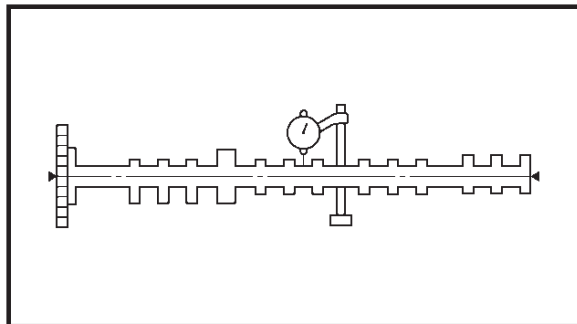
**Exhaust camshaft:**

① 33.00 mm (1.299 in)

② 25.00 mm (0.984 in)



## CAMSHAFTS (Cont'd.)

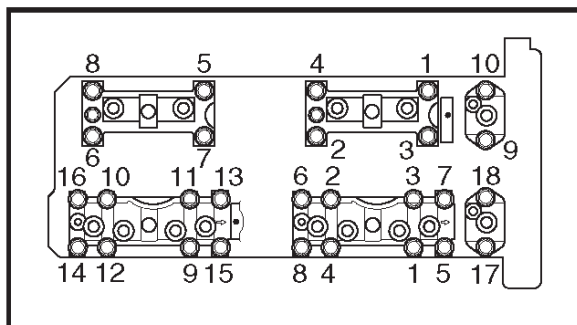


## 3. Measure:

- Camshaft runout  
Out of specification → Replace.



**Maximum camshaft runout:**  
0.03 mm (0.0012 in)

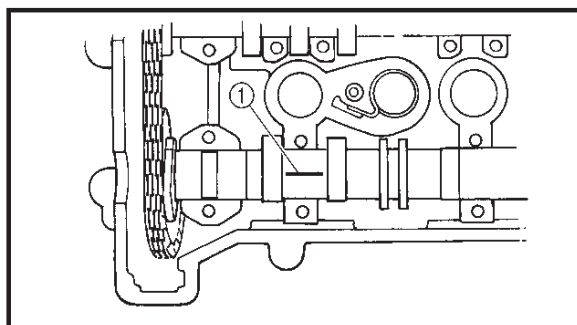


## 4. Measure:

- Camshaft-journal-to-camshaft-cap clearance  
Out of specification → Measure the camshaft journal diameter.



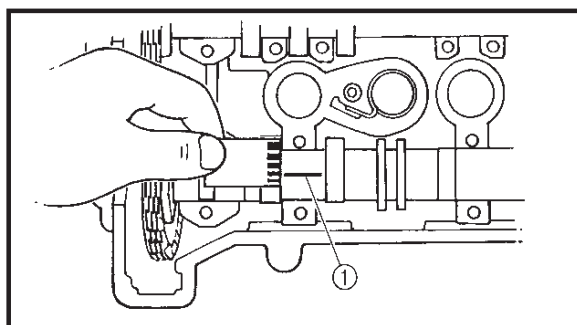
**Camshaft-journal-to-camshaft-cap clearance:**  
0.03–0.06 mm (0.0012–0.0024 in)

**Measurement steps:**

- Install the camshaft into the cylinder head (without the dowel pins and camshaft caps).
- Position a strip of Plastigauge ① onto the camshaft journal as shown.
- Install the dowel pins and camshaft caps.

**NOTE:**

- Tighten the intake and exhaust camshaft cap bolts in the sequence shown.
- Do not turn the camshaft when measuring the camshaft journal-to-camshaft cap clearance with the Plastigauge.

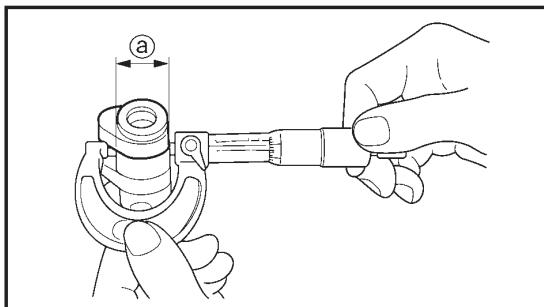


**Camshaft cap bolt:**  
10 N • m (1.0 kgf • m, 7.2 ft • lb)

- Remove the camshaft caps and then measure the width of the Plastigauge ①.



## CAMSHAFTS (Cont'd.)

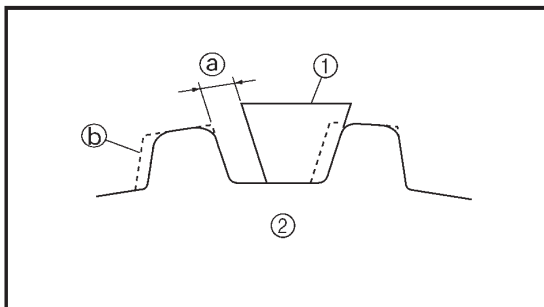


## 5. Measure:

- Camshaft journal diameter (a)  
Out of specification → Replace the camshaft.  
Within specification → Replace the cylinder head and the camshaft caps as a set.



**Camshaft journal diameter:**  
24.46–24.47 mm  
(0.9630–0.9634 in)

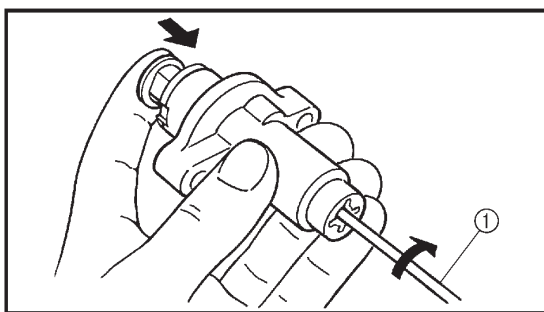


## Camshaft sprockets inspection

## 1. Check:

- Camshaft sprocket  
Wear/damage → Replace the camshaft sprockets and timing chain as a set.

- (a) 1/4 of a tooth  
(b) Correct  
(1) Timing chain  
(2) Camshaft sprocket



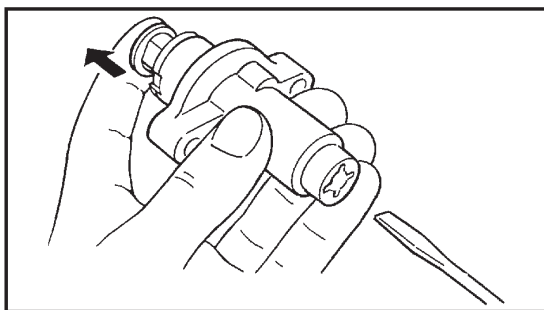
## Timing chain tensioner inspection

## 1. Check:

- Timing chain tensioner  
Cracks/damage/rough movement → Replace.

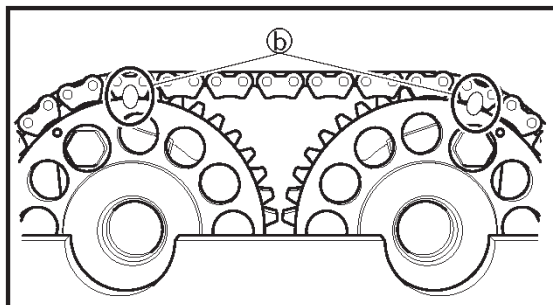
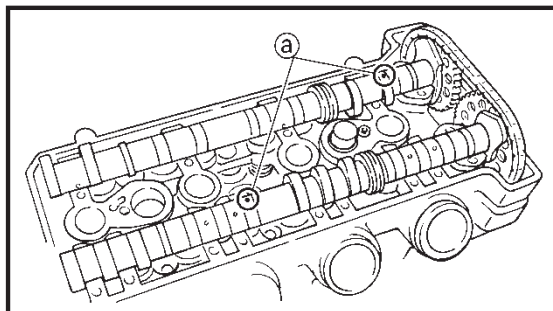
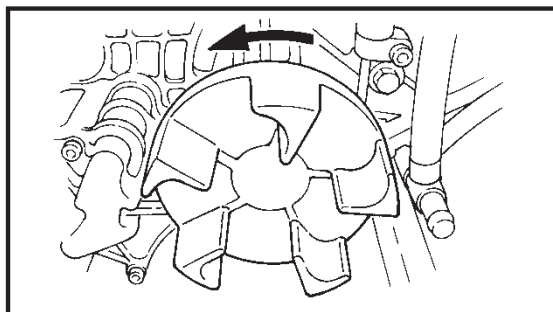
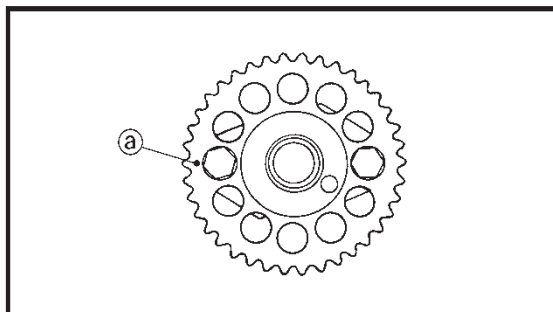
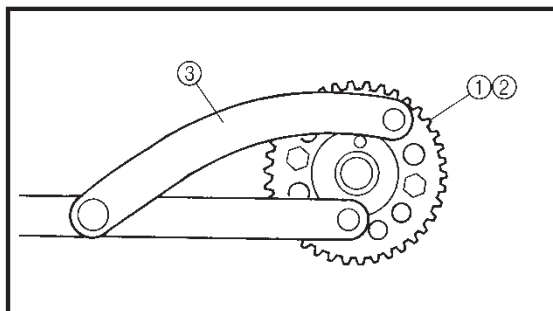
## Checking steps:

- While lightly pressing the timing chain tensioner rod by hand, turn the tensioner rod fully clockwise with a thin screwdriver (1).
- Remove the screwdriver and slowly release the timing chain tensioner rod.
- Make sure that the timing chain tensioner rod comes out of the timing chain tensioner housing smoothly. If there is rough movement, replace the timing chain tensioner.





## CAMSHAFTS (Cont'd.)



## Camshaft installation

## 1. Install:

- Exhaust camshaft sprocket ①
- Intake camshaft sprocket ②  
(with the special tool ③)



**Universal magneto and rotor holder:**

YU-01235

**Rotor holder:**

90890-01235

**NOTE:**

Install the camshaft sprocket with the punch mark ① facing outside.



**Camshaft sprocket bolt:**

24 N • m (2.4 kgf • m, 17 ft • lb)

## 2. Install:

- Exhaust camshaft
- Intake camshaft
- Exhaust camshaft caps
- Intake camshaft caps

**Installation steps:**

- Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.
- Install the timing chain onto both camshaft sprockets, and then install the camshaft.

**CAUTION:**

**Do not turn the crankshaft when installing the camshaft to avoid damage or improper valve timing.**

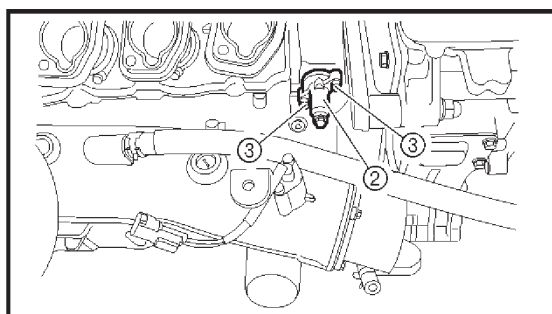
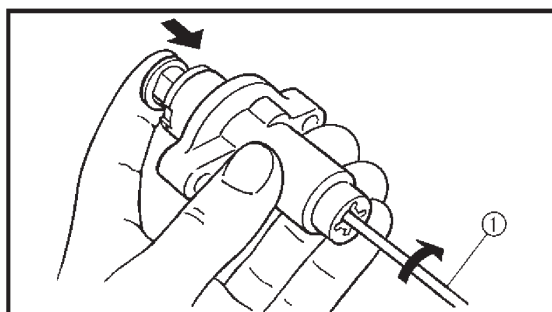
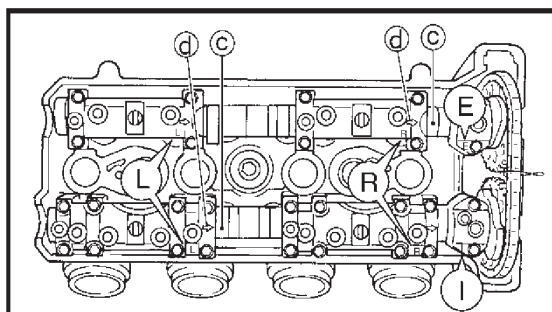
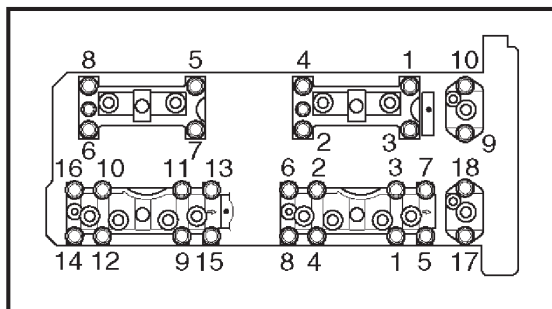
**NOTE:**

- Make sure that the punch marks ① on the camshafts face up.
- Be sure to align the alignment marks ② made during removal to install the timing chain and camshaft sprockets.





## CAMSHAFTS (Cont'd.)



- Install the exhaust and intake camshaft caps.

**NOTE:**

Gradually tighten the intake and exhaust camshaft cap bolts in 2-3 steps in the sequence shown.

**Camshaft cap bolt:**

10 N • m (1.0 kgf • m, 7.2 ft • lb)

**NOTE:**

Make sure that the punch marks (C) on the camshafts are aligned with the arrow marks (d) on the camshaft caps.

Out of alignment → Reinstall.

- Remove the wire from the timing chain.

## 3. Install:

- Timing chain tensioner

**Installation steps:**

- While lightly pressing the timing chain tensioner rod by hand, turn the tensioner rod fully clockwise with a thin screwdriver (1).

**NOTE:**

Make sure that the tensioner rod has been fully set clockwise.

- With the timing chain tensioner rod turned all the way into the timing chain tensioner housing (with the thin screwdriver still installed), install the gasket and the timing chain tensioner (2) onto the cylinder block.

**⚠ WARNING**

**Always use a new gasket.**

- Tighten the timing chain tensioner bolts (3) to the specified torque.

**NOTE:**

The "UP" mark on the timing chain tensioner should face up.



## CAMSHAFTS (Cont'd.)

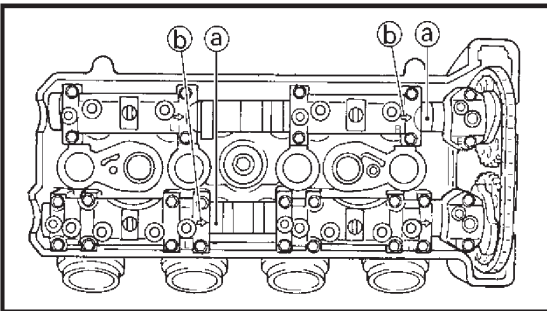
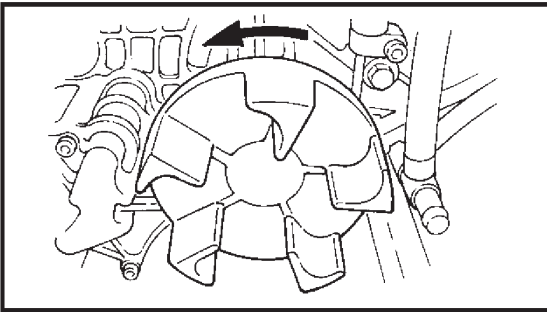


**Timing chain tensioner bolt:**  
10 N • m (1.0 kgf • m, 7.2 ft • lb)

- Remove the screwdriver, make sure the timing chain tensioner rod releases, and then tighten the cap bolt to the specified torque.



**Cap bolt:**  
10 N • m (1.0 kgf • m, 7.2 ft • lb)



## 4. Turn:

- Drive coupling  
(several turns counterclockwise)

## 5. Check:

Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.

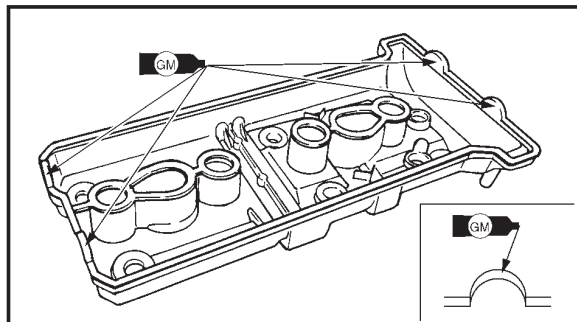
- Camshaft punch marks (a)  
Make sure that the camshaft punch marks are aligned with the arrow marks (b) on the camshaft caps.  
Out of alignment → Adjust.  
Refer to the installation steps above.

## 6. Measure:

- Valve clearance  
Out of specification → Adjust.  
Refer to "POWER UNIT" in Chapter 3.



## CAMSHAFTS (Cont'd.)



## 7. Install:

- Cylinder head cover gasket
- Cylinder head cover

**NOTE:**

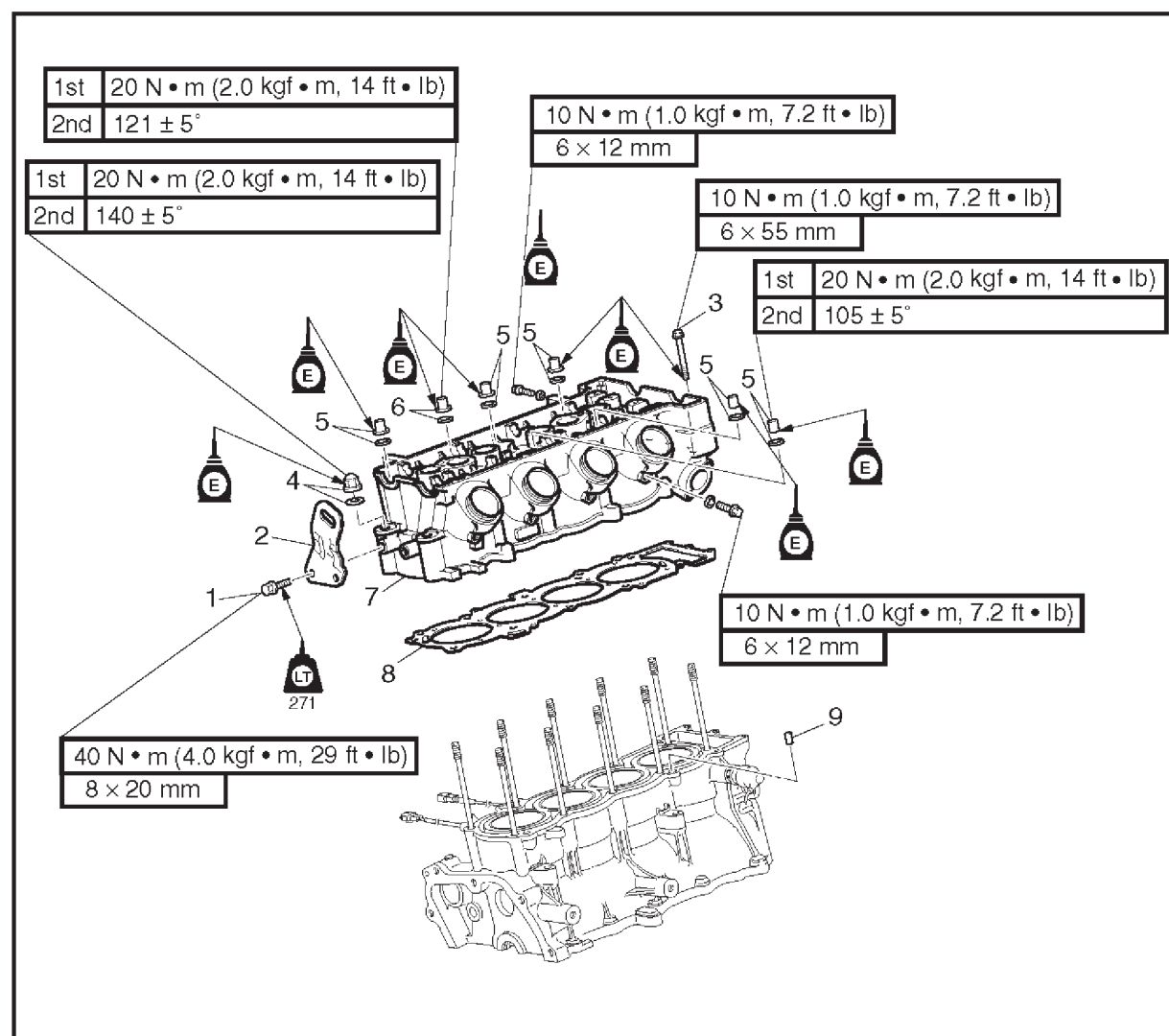
- Apply Gasket Maker onto the mating surfaces of the cylinder head cover gasket and cylinder head.
- Tighten the cylinder head cover bolts stages and in a crisscross pattern.



**Cylinder head cover bolt:**  
**12 N • m (1.2 kgf • m, 8.7 ft • lb)**



## CYLINDER HEAD EXPLODED DIAGRAM

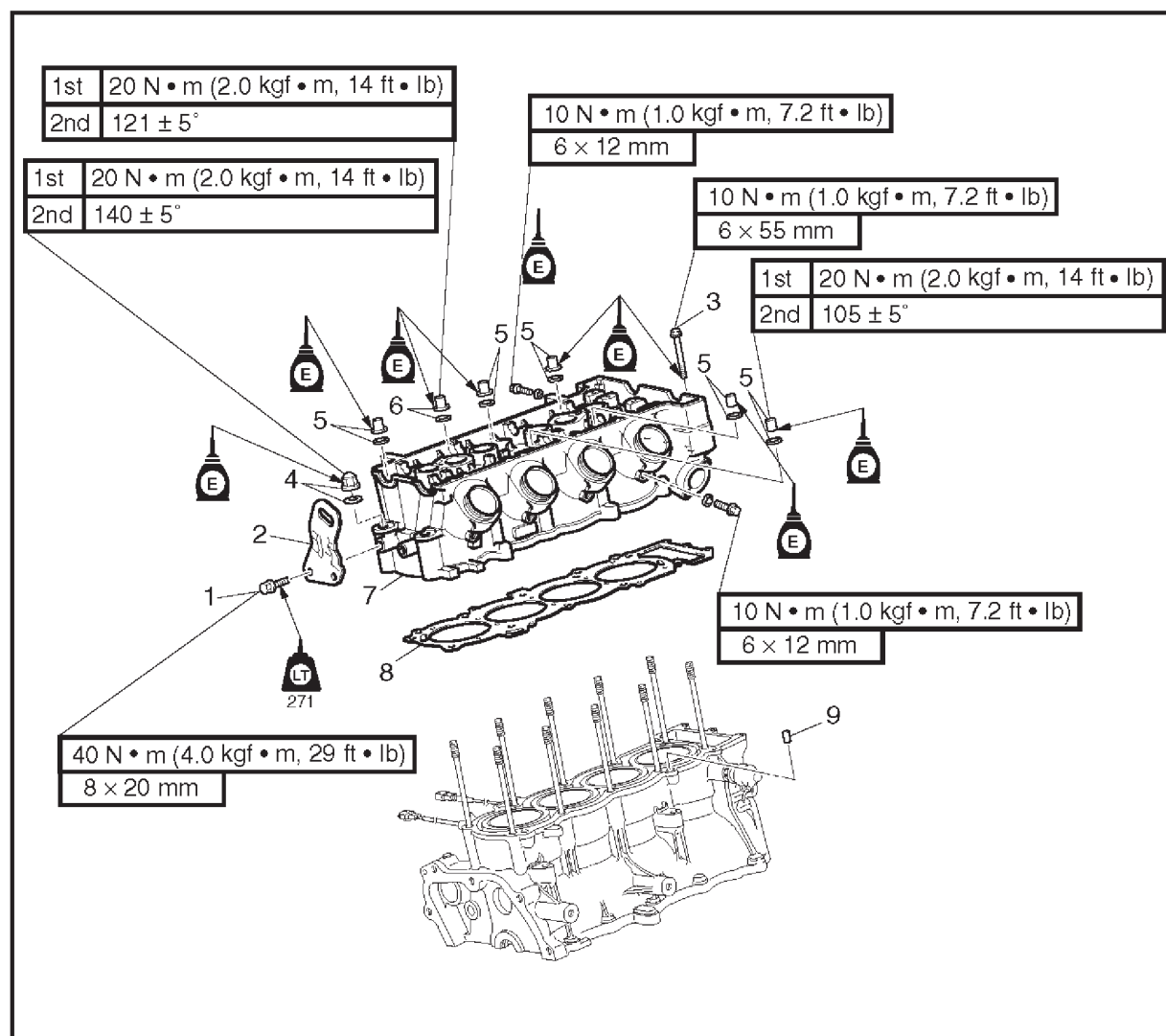


## REMOVAL AND INSTALLATION CHART

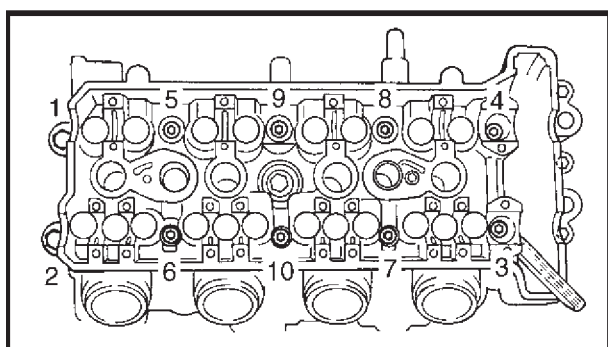
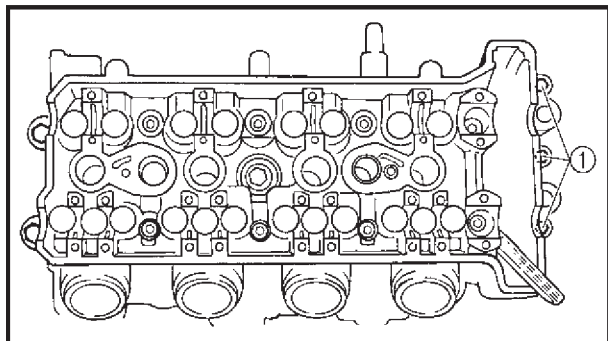
Step	Procedure/Part name	Q'ty	Service points
	<b>CYLINDER HEAD REMOVAL</b>		
	Engine unit		Follow the left "Step" for removal.
	Air filter case		Refer to "ENGINE UNIT".
	Exhaust pipe 3		Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
	Exhaust pipes 1 and 2		Refer to "EXHAUST PIPE 3".
	Oil tank		Refer to "EXHAUST PIPES 1 AND 2".
	Intake and exhaust camshaft		Refer to "OIL TANK".
1	Bolt	2	Refer to "CAMSHAFTS".
2	Hanger	1	
3	Bolt	3	



## CYLINDER HEAD EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
4	Nut/washer	2/2	<div>Not reusable</div> <div>Reverse the removal steps for installation.</div>
5	Nut/washer	6/6	
6	Nut/washer	2/2	
7	Cylinder head	1	
8	Cylinder head gasket	1	
9	Dowel pin	2	

**CYLINDER HEAD (Con't.d)****SERVICE POINTS****Cylinder head removal**

1. Remove:
  - Cylinder head bolts ①

2. Remove:
  - Cylinder head nuts

**NOTE:**

Loosen the cylinder head nuts in the sequence shown.

**Cylinder head inspection**

1. Eliminate:
  - Combustion chamber carbon deposits (with a rounded scraper)

**NOTE:**

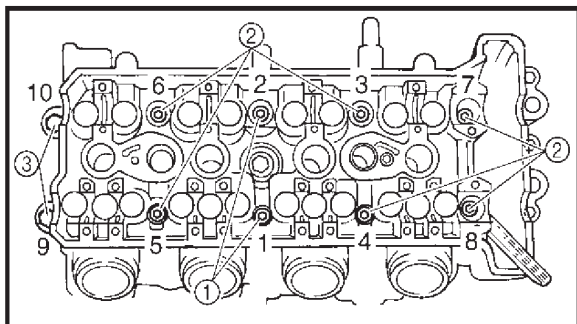
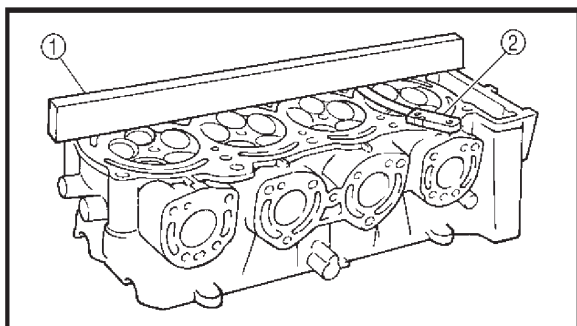
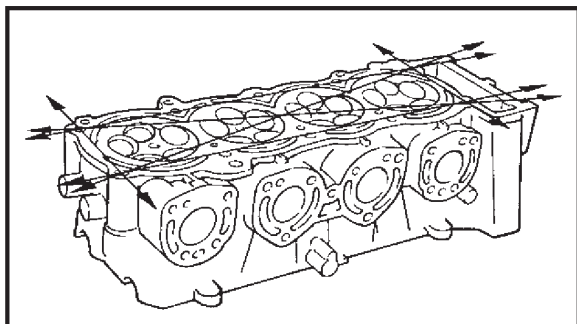
Do not use a sharp instrument to avoid damaging or scratching:

- spark plug bore threads
- valve seats

2. Check:
  - Cylinder head  
Damage/scratches → Replace.
  - Cylinder head water jacket  
Mineral deposits/rust → Eliminate.



## CYLINDER HEAD (Cont'd.)



## 3. Measure:

- Cylinder head warpage  
Out of specification → Replace the cylinder head.



**Cylinder head warpage limit:**  
0.1 mm (0.004 in)

**Measurement steps:**

- Place a straightedge ① and a thickness gauge ② across the cylinder head.
- Measure the warpage.
- If the limit is exceeded, replace the cylinder head.

**Cylinder head installation**

## 1. Install:

- Cylinder head

**NOTE:**

- Pass the timing chain through the timing chain cavity.
- Lubricate the cylinder head nuts with engine oil.
- Tighten the cylinder head nuts in the sequence shown.

**Cylinder head nut ①:**

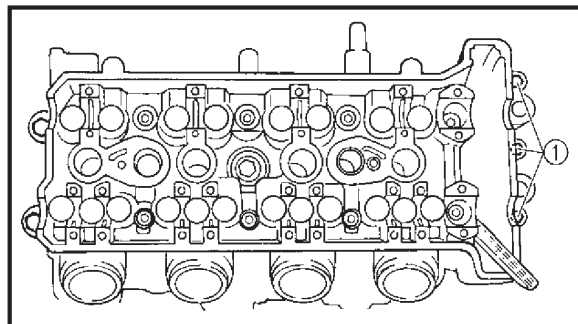
- 1st:  
20 N • m (2.0 kgf • m, 14 ft • lb)  
2nd:  
121 ± 5°

**Cylinder head nut ②:**

- 1st:  
20 N • m (2.0 kgf • m, 14 ft • lb)  
2nd:  
105 ± 5°

**Cylinder head nut ③:**

- 1st:  
20 N • m (2.0 kgf • m, 14 ft • lb)  
2nd:  
140 ± 5°

**CYLINDER HEAD (Cont'd.)**

2. Tighten:

- Cylinder head bolts ①

**NOTE:**

Lubricate the cylinder head bolts with engine oil.

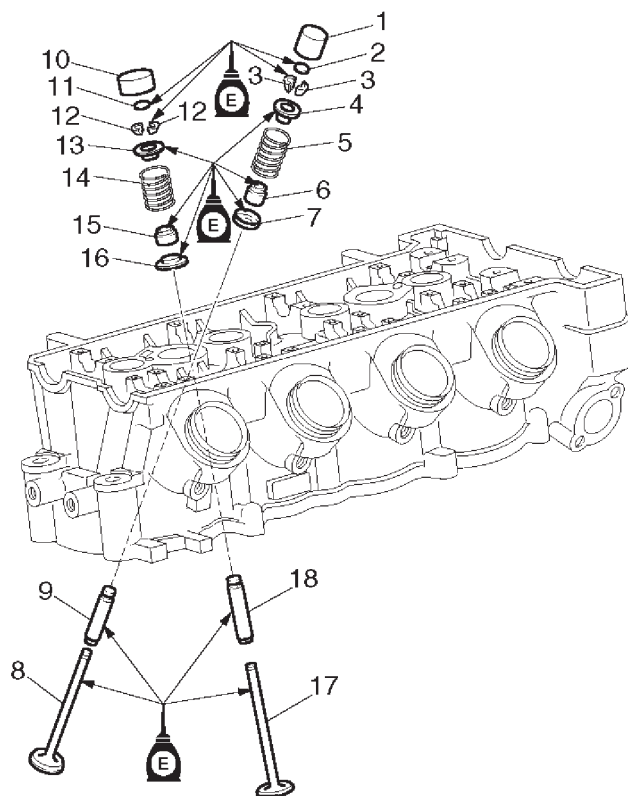


**Cylinder head bolt:**  
10 N • m (1.0 kgf • m, 7.2 ft • lb)





## VALVES AND VALVE SPRINGS EXPLODED DIAGRAM

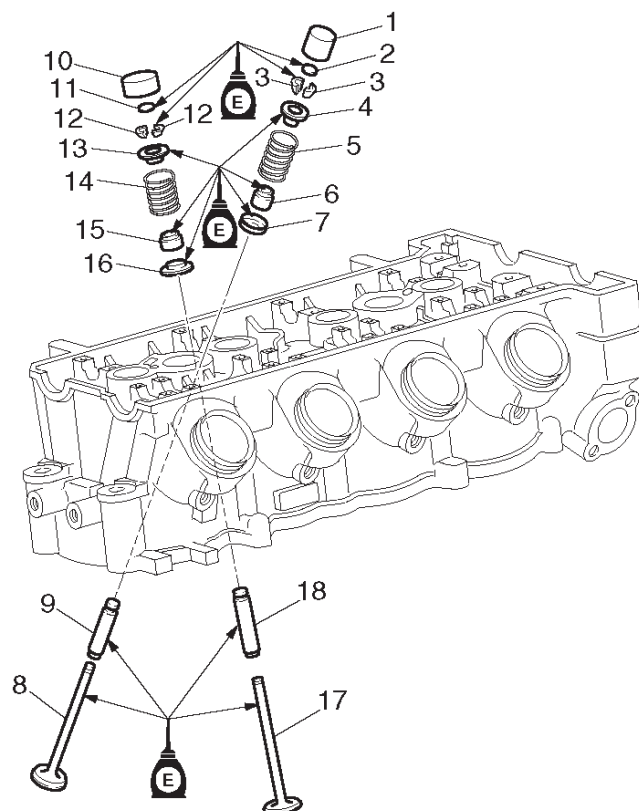


### REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>VALVES AND VALVE SPRINGS REMOVAL</b>		Follow the left "Step" for removal.
	Cylinder head		Refer to "CYLINDER HEAD".
1	Intake valve lifter	12	
2	Intake valve pad	12	
3	Intake valve cotter	24	
4	Intake valve upper spring seat	12	
5	Intake valve spring	12	
6	Intake valve oil seal	12	<b>Not reusable</b>
7	Intake valve lower spring seat	12	
8	Intake valve	12	
9	Intake valve guide	12	<b>Not reusable</b>



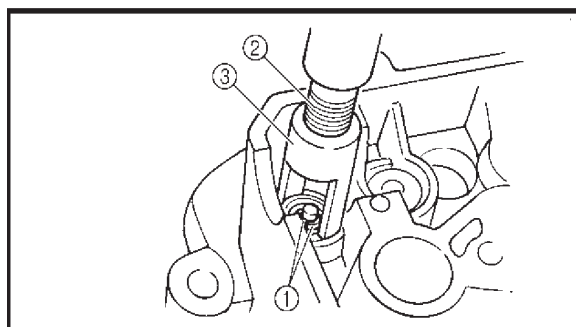
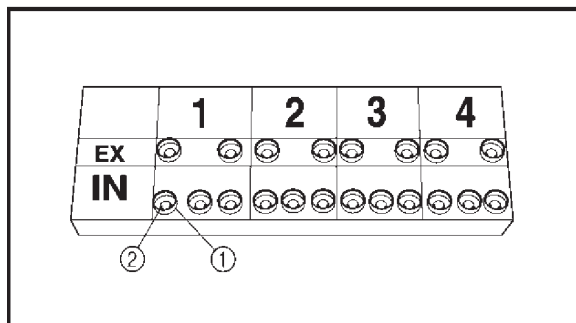
## VALVES AND VALVE SPRINGS EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
10	Exhaust valve lifter	8	<div>Not reusable</div> <div>Not reusable</div> <div>Reverse the removal steps for installation.</div>
11	Exhaust valve pad	8	
12	Exhaust valve cotter	16	
13	Exhaust valve upper spring seat	8	
14	Exhaust valve spring	8	
15	Exhaust valve oil seal	8	
16	Exhaust valve lower spring seat	8	
17	Exhaust valve	8	
18	Exhaust valve guide	8	



## VALVES AND VALVE SPRINGS (Cont'd.)



## SERVICE POINTS

### Valve removal

1. Remove:
  - Valve lifter ①
  - Valve pad ②

### NOTE:

Make a note of the position of each valve lifter and valve pad so that they can be reinstalled in their original place.

2. Remove:
  - Valve cotters ①

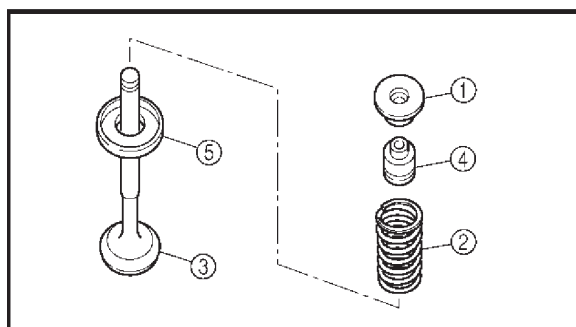
### NOTE:

Remove the valve cotters by compressing the valve spring with the valve spring compressor ② and attachment ③.



**Valve spring compressor:**  
YM-01253/90890-04019

**Valve spring compressor attachment:**  
(for the intake valve)  
YM-4114/90890-04114  
(for the exhaust valve)  
YM-4108/90890-04108



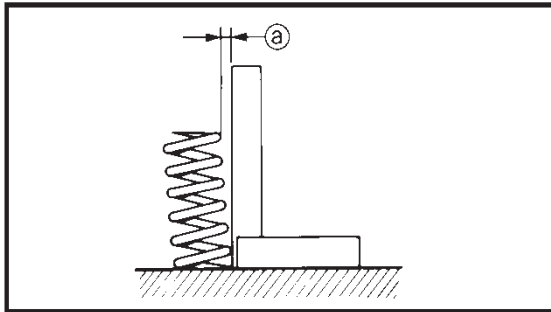
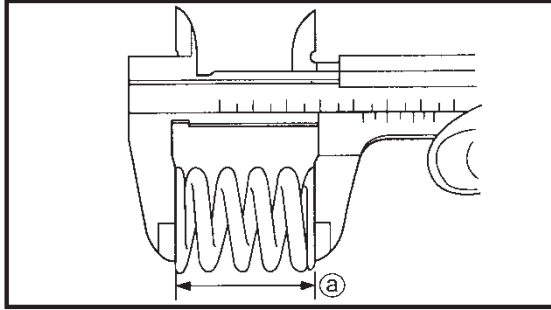
3. Remove:
  - Upper spring seat ①
  - Valve spring ②
  - Valve ③
  - Oil seal ④
  - Lower spring seat ⑤

### NOTE:

Identify the position of each part very carefully so that it can be reinstalled in its original place.



## VALVES AND VALVE SPRINGS (Cont'd.)



## Valve spring inspection

## 1. Measure:

- Valve spring free length <sup>a</sup>  
Out of specification → Replace the valve spring.



## Valve spring free length:

Intake valve spring:

38.90 mm (1.53 in)

Exhaust valve spring:

40.67 mm (1.60 in)

## 2. Measure:

- Valve spring tilt <sup>a</sup>  
Out of specification → Replace the valve spring.



## Valve spring tilt:

Intake valve spring:

1.7 mm (0.067 in)

Exhaust valve spring:

1.8 mm (0.071 in)

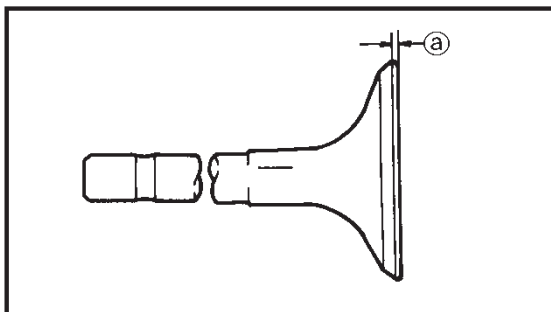
## Valve inspection

## 1. Eliminate:

- Carbon deposits  
(from the valve face and valve seat)

## 2. Check:

- Valve face  
Pitting/wear → Replace the valve.



## 3. Measure:

- Valve margin thickness <sup>a</sup>  
Out of specification → Replace the valve.

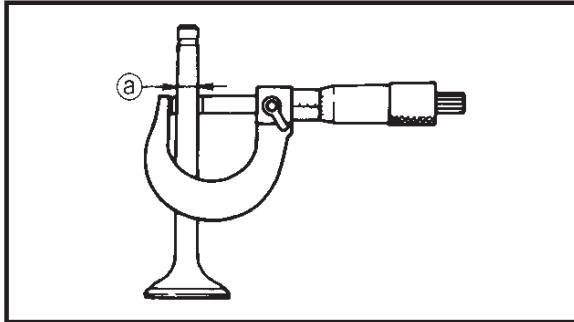


## Valve margin thickness:

0.5–0.9 mm (0.0197–0.0354 in)



## VALVES AND VALVE SPRINGS (Cont'd.)



### 4. Measure:

- Valve stem diameter ①  
Out of specification → Replace the valve.



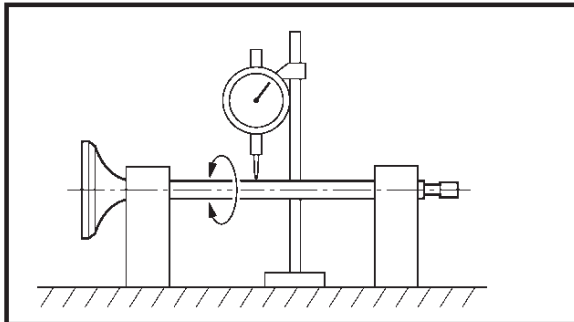
#### Valve stem diameter ①:

##### Intake valve:

3.975–3.990 mm  
(0.1565–0.1571 in)

##### Exhaust valve:

4.465–4.480 mm  
(0.1758–0.1764 in)



### 5. Measure:

- Valve stem runout  
Out of specification → Replace the valve.

#### NOTE: \_\_\_\_\_

- When installing a new valve, always replace the valve guide.
- If the valve is removed or replaced, always replace the oil seal.



#### Valve stem runout:

0.01 mm (0.0004 in)

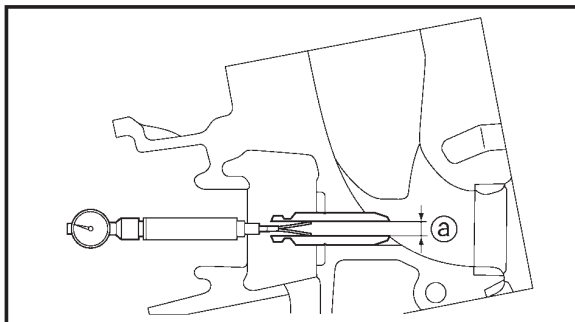
## Valve guide inspection

#### NOTE: \_\_\_\_\_

Before checking the valve guide make sure that the valve stem diameter is within specification.



## VALVES AND VALVE SPRINGS (Cont'd.)



1. Measure:

- Valve guide inside diameter (a)

**Valve guide inside diameter:**

**Intake:**

4.000–4.012 mm  
(0.1575–0.1580 in)

**Exhaust:**

4.500–4.512 mm  
(0.1772–0.1776 in)

2. Calculate the valve stem-to-valve guide clearance as follows. Replace the valve guide if out of specification.

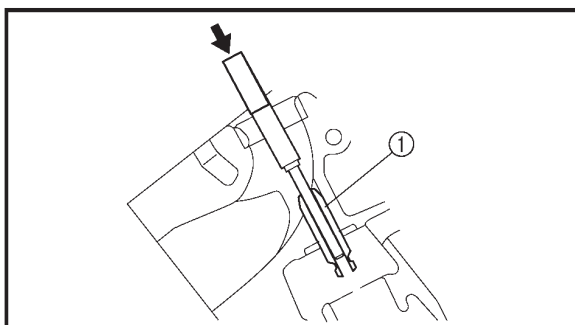
**Valve stem-to-valve guide clearance = valve guide inside diameter – valve stem diameter:**

**Intake:**

0.010–0.037 mm  
(0.0004–0.0015 in)

**Exhaust:**

0.020–0.047 mm  
(0.0008–0.0019 in)

**Valve guide replacement**

1. Remove the valve guide ① by striking the special service tool from the combustion chamber side.

**Valve guide remover:**

**Intake (ø4.0 mm):**

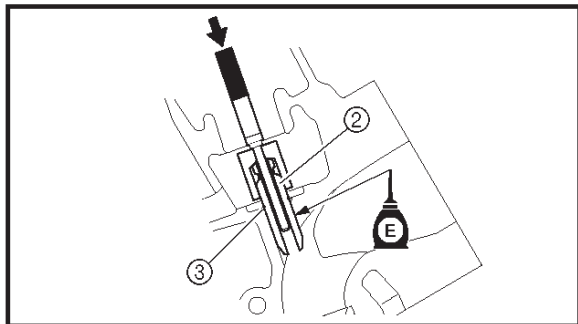
YM-04111/90890-04111

**Exhaust (ø4.5 mm):**

YM-04116/90890-04116



## VALVES AND VALVE SPRINGS (Cont'd.)



2. Install the new valve guide (2) by striking the special service tool from the camshaft side until the valve guide clip (3) contacts the cylinder head.

**NOTE:**

Apply engine oil to the surface of the new valve guide.

**Valve guide remover:**

Intake (ø4.0 mm):

YM-04111/90890-04111

Exhaust (ø4.5 mm):

YM-04116/90890-04116

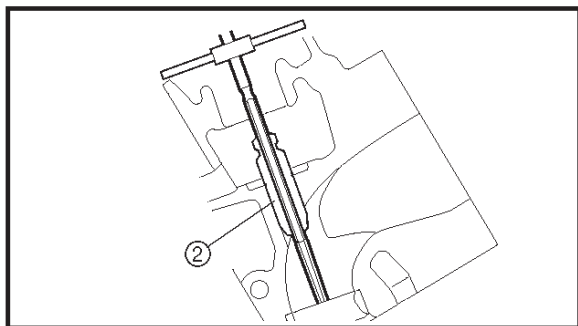
**Valve guide installer:**

Intake (ø4.0 mm):

YM-04112/90890-04112

Exhaust (ø4.5 mm):

YM-04117/90890-04117



3. Insert the special service tool into the valve guide (2), and then ream the valve guide.

**NOTE:**

- Turn the valve guide reamer clockwise to ream the valve guide.
- Do not turn the reamer counterclockwise when removing the reamer.

**Valve guide reamer:**

Intake (ø4.0 mm):

YM-04113/90890-04113

Exhaust (ø4.5 mm):

YM-04118/90890-04118

4. Measure:

- Valve guide inside diameter

**Valve guide inside diameter:**

Intake:

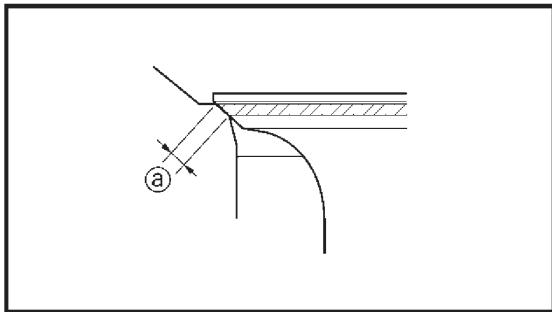
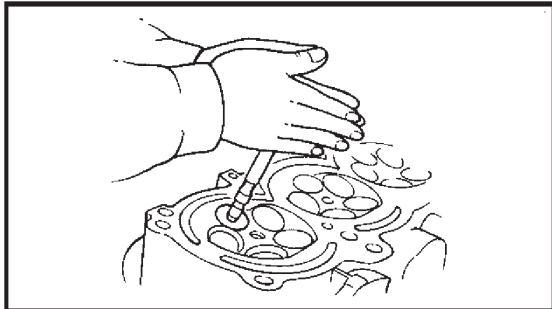
4.000–4.012 mm  
(0.1575–0.1580 in)

Exhaust:

4.500–4.512 mm  
(0.1772–0.1776 in)

**VALVES AND VALVE SPRINGS (Cont'd.)****Valve seat inspection**

1. Eliminate carbon deposits from the valve with a scraper.
2. Apply a thin, even layer of Mechanic's blueing dye (Dykem) onto the valve seat.

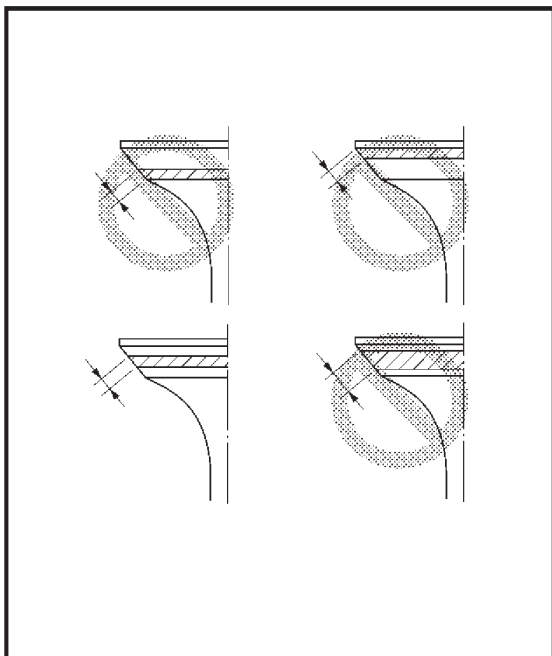


3. Lap the valve slowly on the valve seat with a valve lapper (commercially obtainable) as shown.

4. Measure the valve seat contact width ① where the blueing dye is adhered to the valve face. Reface the valve seat if the valve is not seated properly or if the valve seat contact width is out of specification. Replace the valve guide if the valve seat contact is uneven.



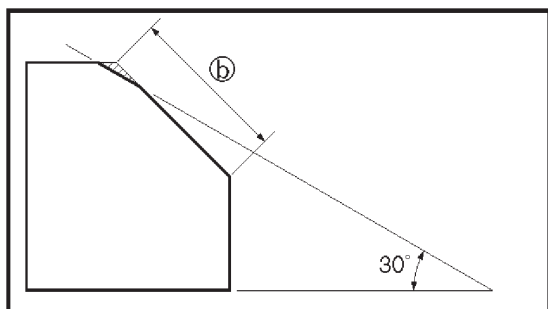
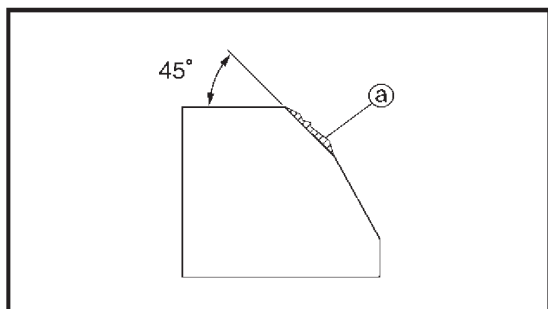
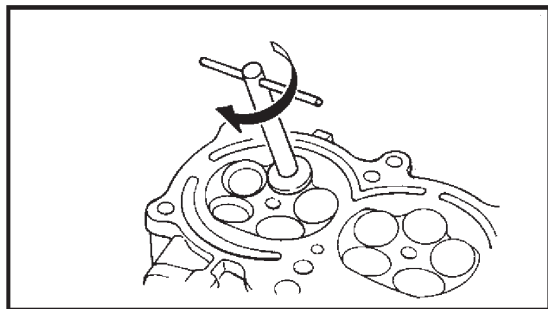
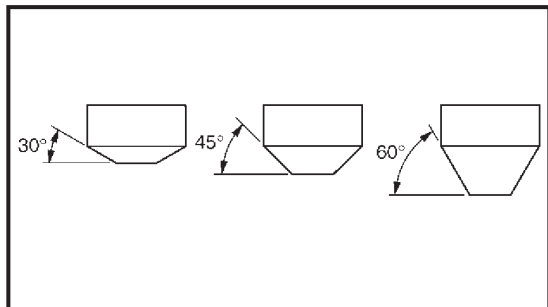
**Valve seat contact width ①:**  
0.9–1.1 mm (0.0354–0.0433 in)







## VALVES AND VALVE SPRINGS (Cont'd.)



## Valve seat reface

1. Reface the valve seat with the valve seat cutter.



## Valve seat cutter holder:

Intake (ø4.0 mm):

90890-06811

Exhaust (ø4.5 mm):

90890-06812

## Valve seat cutter:

30° (Intake):

90890-06815

45° (Intake):

90890-06814

60° (Intake):

90890-06813

30° (exhaust):

90890-06328

45° (exhaust):

90890-06312

60° (exhaust):

90890-06315

## Valve seat cutter set:

YM-91043-C

2. Cut the surface of the valve seat with a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.

(a) Slag or rough surface

**CAUTION:**

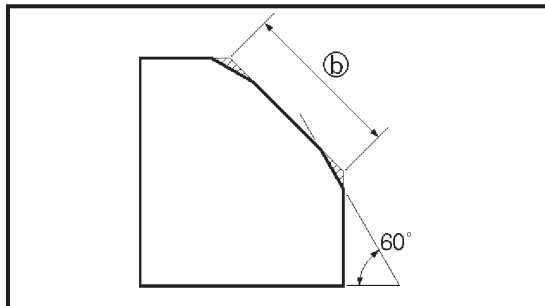
Do not over cut the valve seat. Be sure to turn the cutter evenly downward at a pressure of 40–50 N (4–5 kgf, 8.8–11 lbf) to prevent chatter marks.

3. Use a 30° cutter to adjust the contact width of the top edge of the valve seat.

(b) Previous contact width

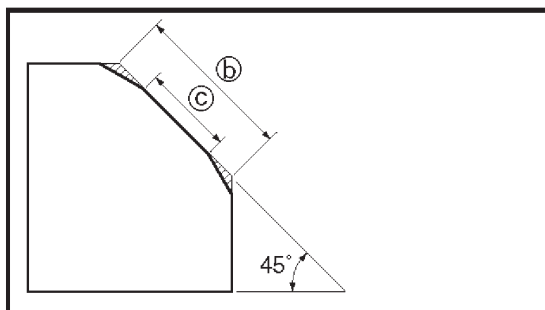


## VALVES AND VALVE SPRINGS (Cont'd.)



4. Use a 60° cutter to adjust the contact width of the bottom edge of the valve seat.

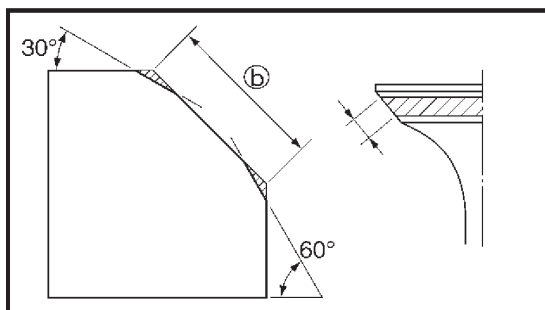
ⓑ Previous contact width



5. Use a 45° cutter to adjust the contact width of the valve seat to specification.

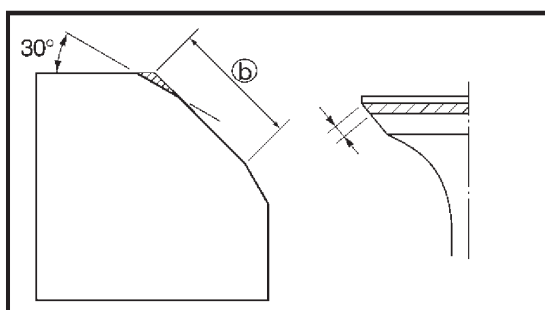
ⓑ Previous contact width

ⓒ Specified contact width



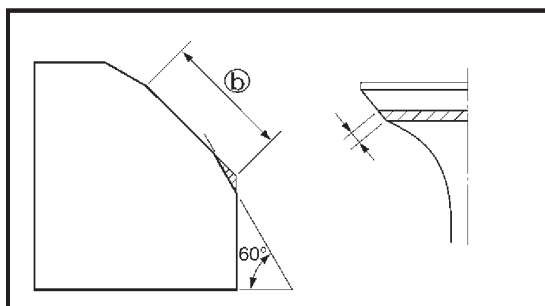
6. If the valve seat contact area is too wide and situated in the center of the valve face, use a 30° cutter to cut the top edge of the valve seat, a 60° cutter to cut the bottom edge to center the area and set its width.

ⓑ Previous contact width



7. If the valve seat contact area is too narrow and situated near the top edge of the valve face, use a 30° cutter to cut the top edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.

ⓑ Previous contact width

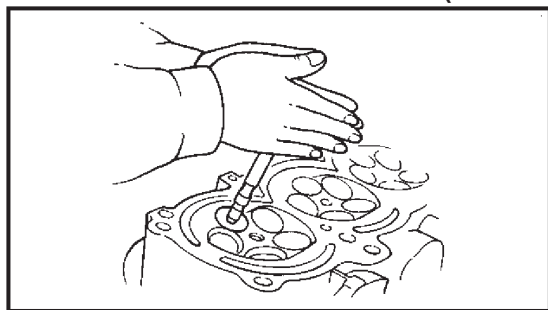


8. If the valve seat contact area is too narrow and situated near the bottom edge of the valve face, use a 60° cutter to cut the bottom edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.

ⓑ Previous contact width



## VALVES AND VALVE SPRINGS (Cont'd.)

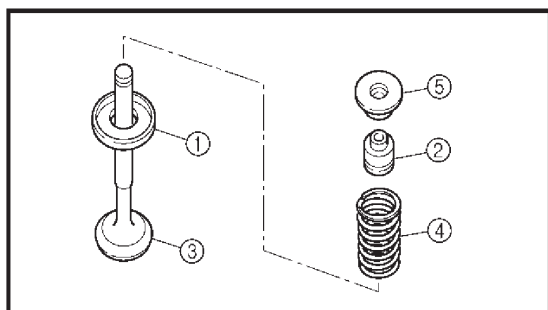


9. Apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using a valve lapper (commercially obtainable).

### CAUTION:

**Do not get the lapping compound on the valve stem and valve guide.**

10. After every lapping procedure, be sure to clean off any remaining lapping compound from the cylinder head and the valve.
11. Check the valve seat contact area of the valve again.



### Valve Installation

#### 1. Install:

- Lower spring seat ①
- Oil seal ②
- Valve ③
- Valve spring ④
- Upper spring seat ⑤  
(into the cylinder head)

### NOTE:

- Make sure that each valve is installed in its original place. Refer to the following embossed marks.

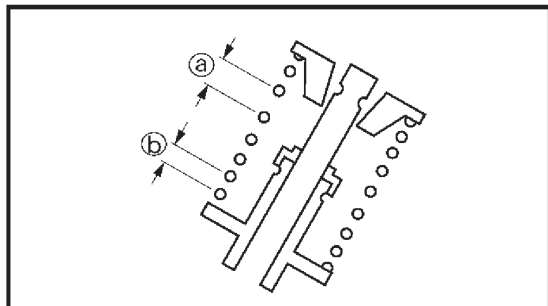
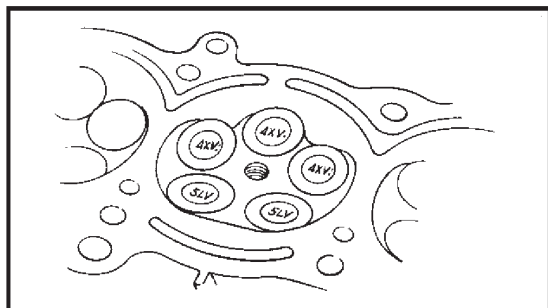
Right and left intake valve(s): "4XV."

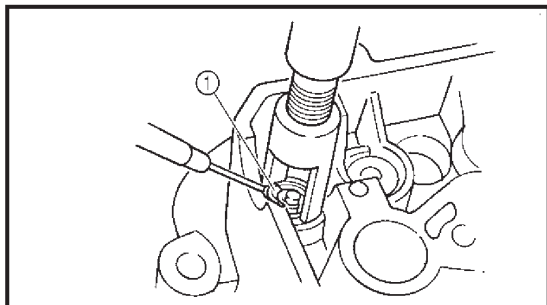
Middle intake valve(s): "4XV."

Exhaust valve(s): "5LV"

- Install the valve spring with the larger pitch ① facing up.

② Smaller pitch



**VALVES AND VALVE SPRINGS (Cont'd.)**

2. Compress the valve spring, and then install the valve cotter ① using a thin screwdriver with a small amount of grease applied to it.



**Valve spring compressor:**

**YM-01253/90890-04019**

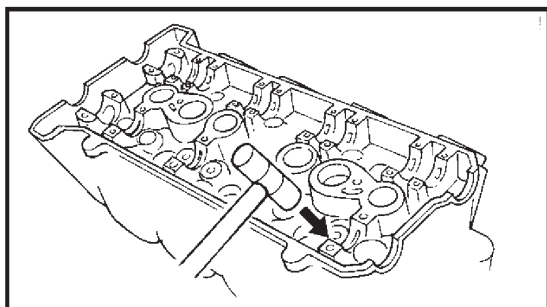
**Valve spring compressor attachment:**

**(for the intake valve)**

**YM-4114/90890-04114**

**(for the exhaust valve)**

**YM-4108/90890-04108**



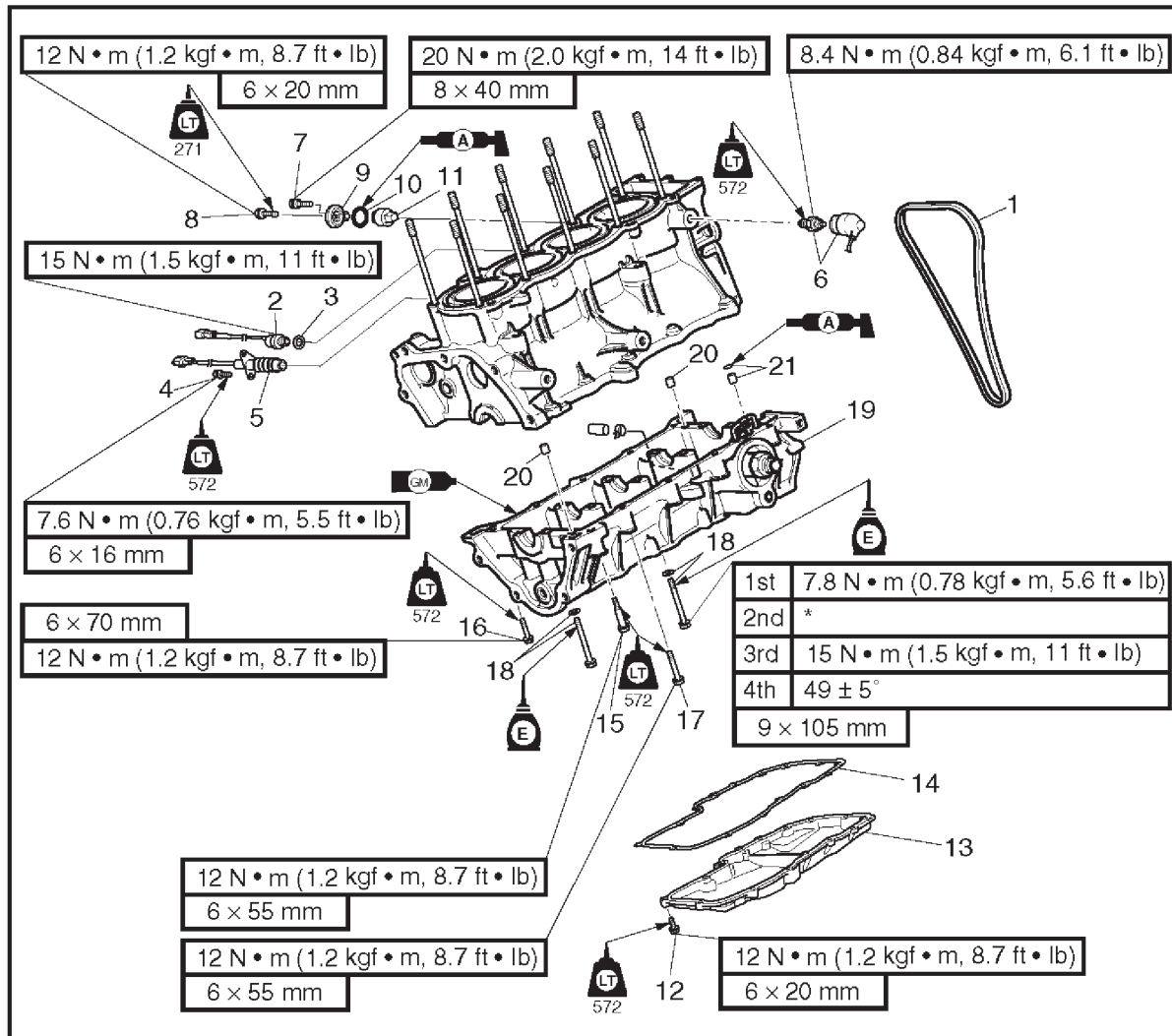
3. Lightly tap the valve spring retainer with a plastic hammer to set the valve cotter securely.

**NOTE:**

Apply engine oil to the valve pads and valve lifters before installation.



## CRANKCASE EXPLODED DIAGRAM



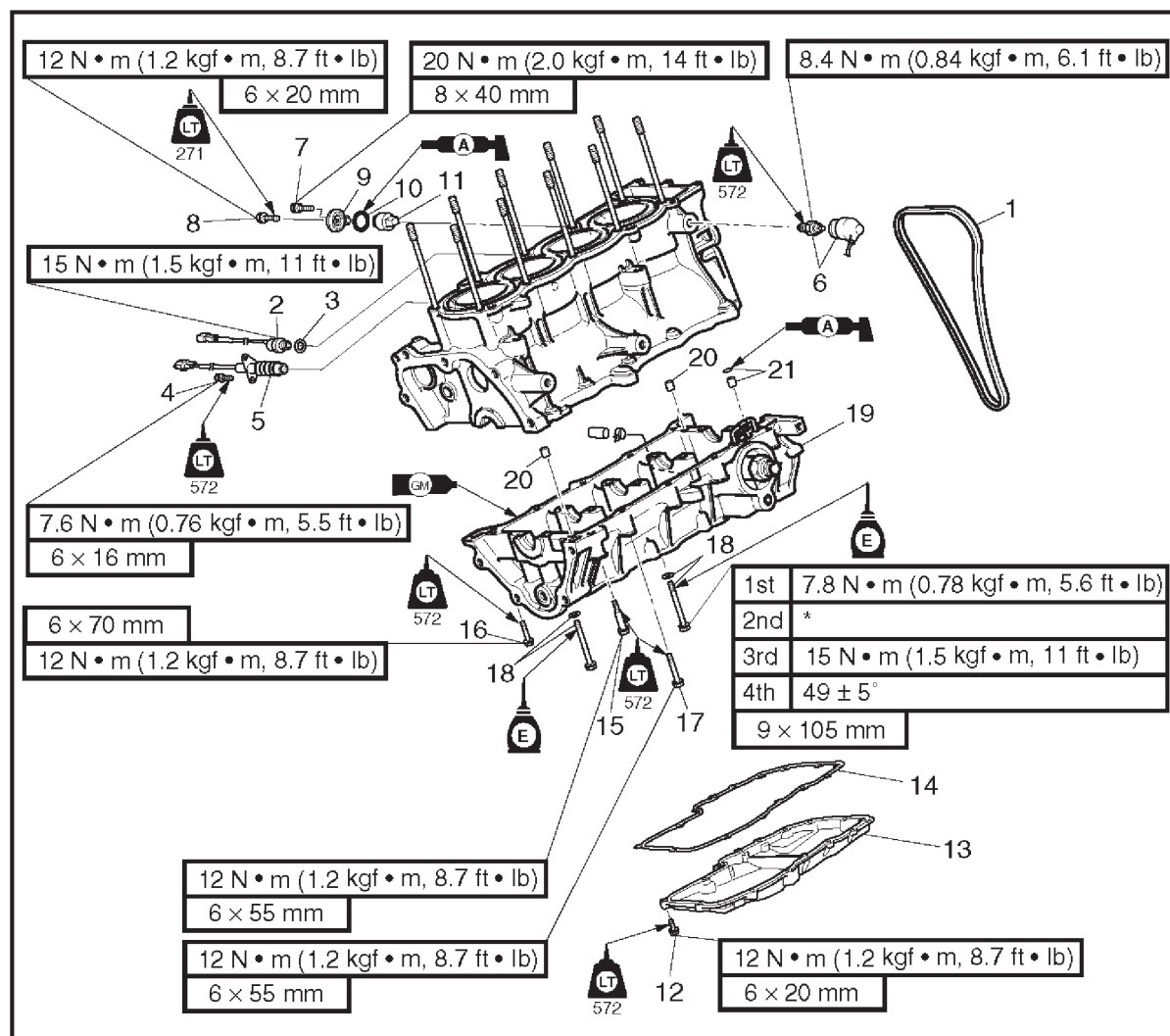
## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>OIL PAN AND CRANKCASE REMOVAL</b> Engine unit Air filter case  Exhaust pipe 3 Exhaust pipes 1 and 2 Exhaust manifold Generator cover		Follow the left "Step" for removal.  Refer to "ENGINE UNIT". Refer to "FUEL INJECTION SYSTEM" in Chapter 4. Refer to "EXHAUST PIPE 3". Refer to "EXHAUST PIPES 1 AND 2". Refer to "EXHAUST MANIFOLD". Refer to "GENERATOR AND STARTER MOTOR".

\*: Loosen completely



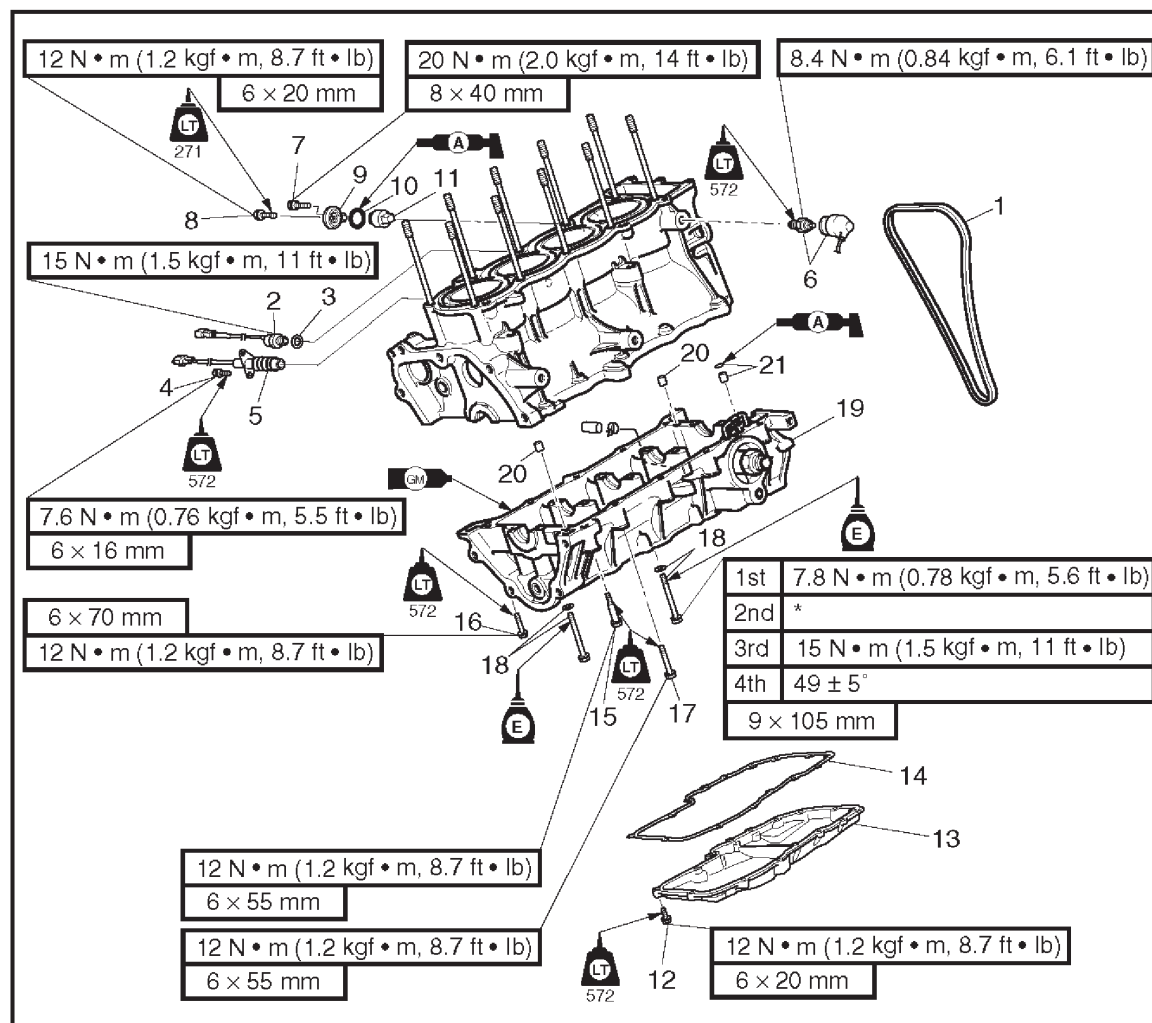
# CRANCASE (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
	Oil tank		Refer to "OIL TANK".
	Oil pump		Refer to "OIL PUMP".
	Reduction drive gear case		Refer to "REDUCTION DRIVE GEAR".
	Cylinder head		Refer to "CAMSHAFTS".
1	Timing chain	1	
2	Engine temperature sensor	1	
3	Washer	1	
4	Bolt	2	
5	Thermoswitch (engine)	1	
6	Oil pressure switch	1	



## CRANCASE (Cont'd.) EXPLODED DIAGRAM

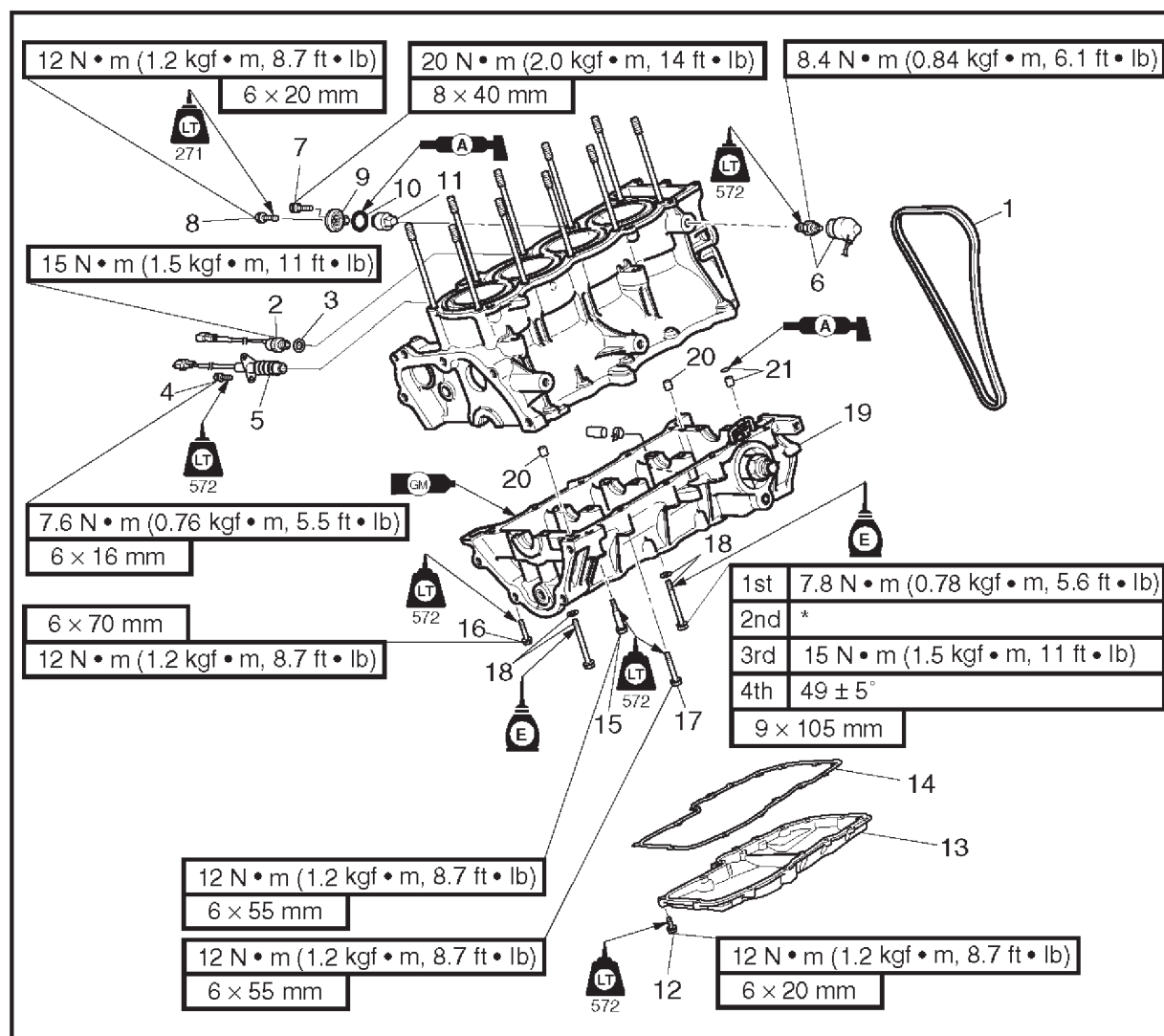


Step	Procedure/Part name	Q'ty	Service points
7	Bolt	1	Not reusable
8	Bolt	1	
9	Anode cover	1	
10	Grommet	1	
11	Anode	1	
12	Bolt	15	
13	Oil pan	1	
14	Gasket	1	
15	Bolt	2	
16	Bolt	1	
17	Bolt	7	



## CRANCASE (Cont'd.)

## EXPLODED DIAGRAM

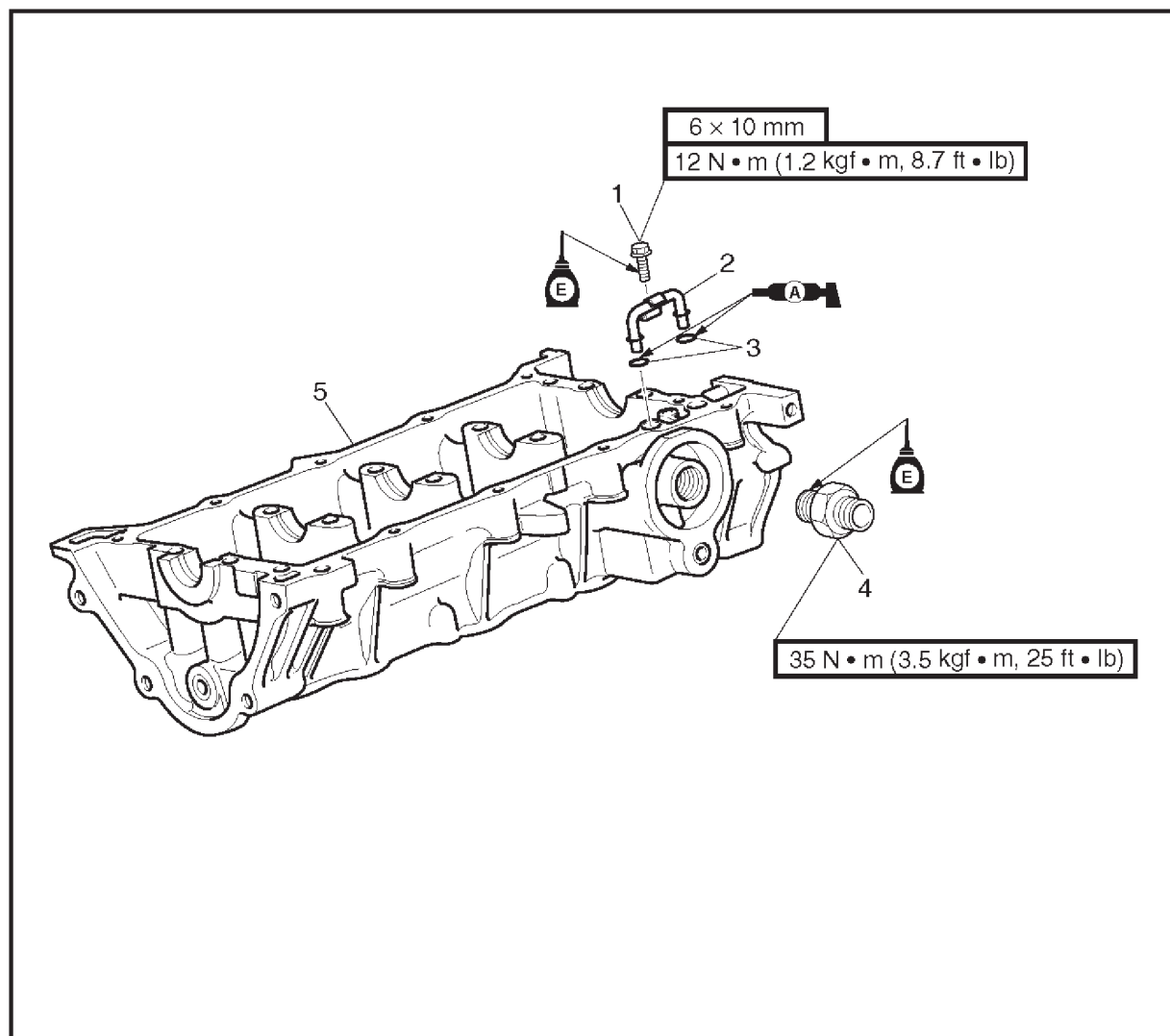


Step	Procedure/Part name	Q'ty	Service points
18	Bolt/washer	10/10	<b>Not reusable</b>
19	Lower crankcase	1	
20	Dowel pin	2	
21	Dowel pin/O-ring	1/1	<b>Not reusable</b>
Reverse the removal steps for installation.			





## CRANCASE (Cont'd.) EXPLODED DIAGRAM

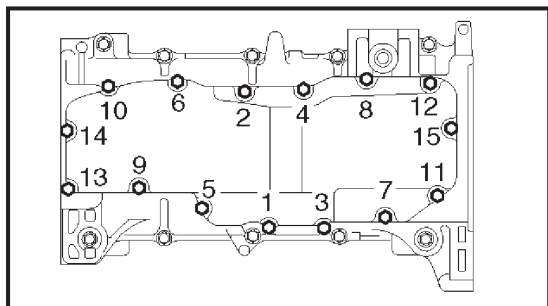


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>OIL PIPE AND OIL FILTER BOLT REMOVAL</b>		Follow the left "Step" for removal.
	Crankshaft		Refer to "CRANKSHAFT".
1	Bolt	1	<b>Not reusable</b>
2	Oil pipe	1	
3	O-ring	2	
4	Oil filter bolt	1	Reverse the removal steps for installation.
5	Lower crankcase	1	



## CRANCASE (Cont'd.)



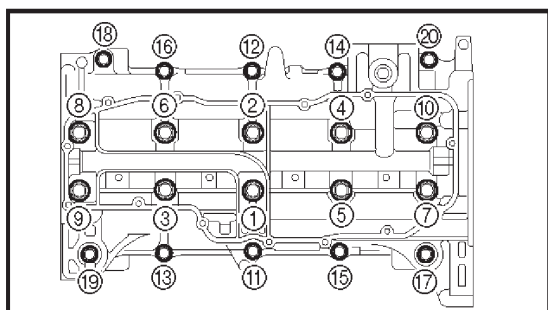
## SERVICE POINTS

## Crankcase disassembly

1. Remove:
  - Oil pan bolts

**NOTE:**

- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the oil pan indicate the oil pan tightening sequence.



2. Remove:
  - Crankcase bolts

**NOTE:**

- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the crankcase indicate the crankcase tightening sequence.

3. Remove:
  - Lower crankcase

**CAUTION:**

Tap on one side of the crankcase with a soft-face hammer. Tap only on reinforced portions of the crankcase, not on the crankcase mating surfaces. Work slowly and carefully and make sure the crankcase halves separate evenly.

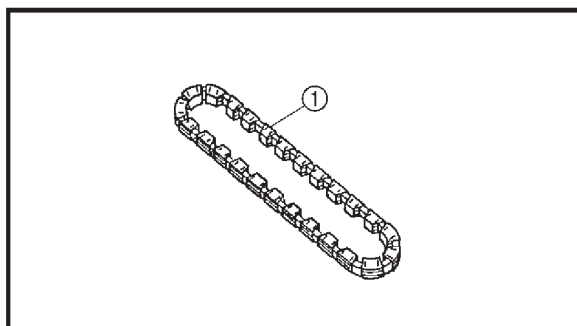
- M9 × 105 mm bolts: ①–⑩  
 M6 × 55 mm bolts: ⑪–⑮  
 M6 × 55 mm bolts: ⑰, ⑱  
 M6 × 70 mm bolts: ⑲  
 M6 × 55 mm bolts: ⑳

**CRANCASE (Cont'd.)**

4. Remove:
  - Dowel pins

**Crankcase Inspection**

1. Thoroughly wash the crankcase halves in a mild solvent.
2. Thoroughly clean all the gasket surfaces and crankcase mating surfaces.
3. Check:
  - Crankcase  
Cracks/damage → Replace.
  - Oil delivery passages  
Obstruction → Blow out with compressed air.

**Timing chain inspection**

1. Check:
  - Timing chain ①  
Damage/stiffness → Replace the timing chain and camshaft sprockets as a set.



## CRANCASE (Cont'd.)

## Crankcase assembly

## 1. Lubricate:

Crankshaft journal bearings  
(with the recommended lubricant)



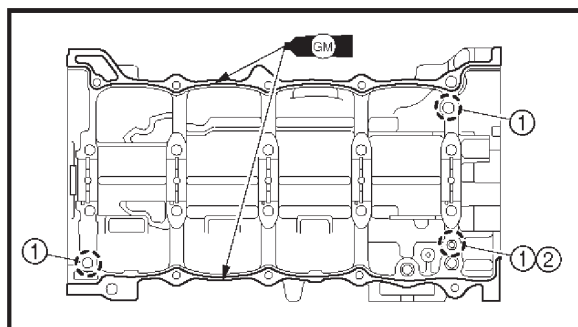
**Recommended lubricant:**  
Engine oil

## 2. Apply:

- Gasket Maker  
(onto the crankcase mating surfaces)

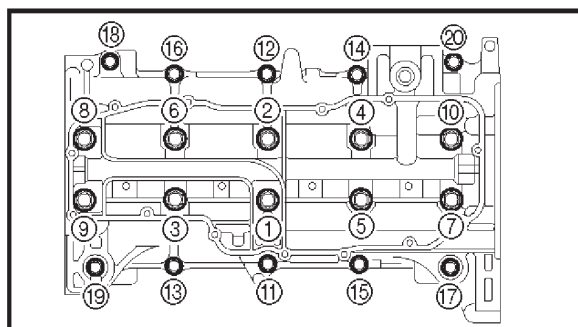
**NOTE:**

Do not allow any Gasket Maker to come into contact with the oil gallery or crankshaft journal bearings.



## 3. Install:

- Dowel pins ①
- O-ring ②



## 4. Install:

- Crankcase bolts

**NOTE:**

- Lubricate the bolt ①—⑩ threads and washers with engine oil.
- Finger tighten the crankcase bolts.

M9 × 105 mm bolts: ①—⑩

M6 × 55 mm bolts: ⑪—⑯

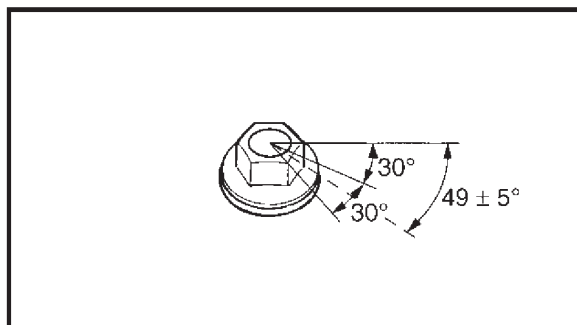
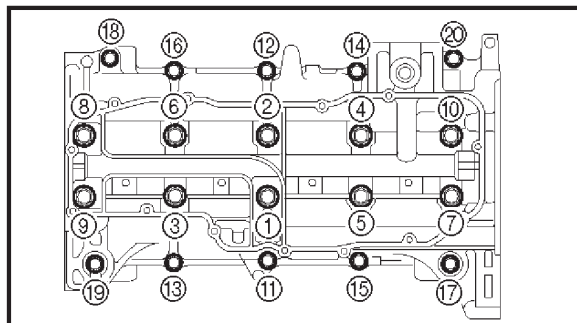
M6 × 55 mm bolts: ⑰, ⑱

M6 × 70 mm bolts: ⑲

M6 × 55 mm bolts: ⑳



## CRANCASE (Cont'd.)



## 5. Tighten:

- Crankcase bolts ①—⑩

**NOTE:**

- Do not reuse crankcase bolts ①—⑩.
- The tightening procedure of crankcase bolts ①—⑩ is angle controlled, therefore tighten the bolts using the following procedure.

**Tightening steps:**

- Tighten the bolts in the tightening sequence cast on the crankcase.

**Crankcase bolt ①—⑩:****1st:**

**7.8 N • m**  
**(0.78 kgf • m, 5.6 ft • lb)**

- Loosen and retighten the crankcase bolts in the proper tightening sequence as shown.

**Crankcase bolt ①—⑩:****2nd:**

**Loosen completely**

**3rd:**

**15 N • m (1.5 kgf • m, 11 ft • lb)**

- Tighten the crankcase bolts further to reach the specified angle  $49^\circ$  in the proper tightening sequence as shown.

**Crankcase bolt ①—⑩:****Final:**

**Specified angle  $49 \pm 5^\circ$**

**⚠ WARNING**

When the bolts are tightened more than the specified angle, do not loosen the bolt and then retighten it.

Replace the bolt with a new one and perform the procedure again.



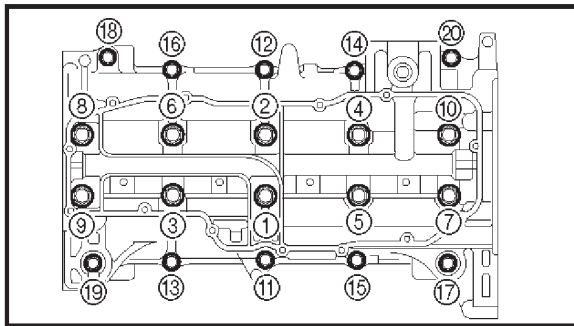
## CRANCASE (Cont'd.)

**CAUTION:**

- Do not use a torque wrench to tighten the bolt to the specified angle.
- Tighten the bolt until it is at the specified angle.

**NOTE:**

When using a hexagonal bolt, note that the angle from one corner to another is 60°.



## 6. Tighten:

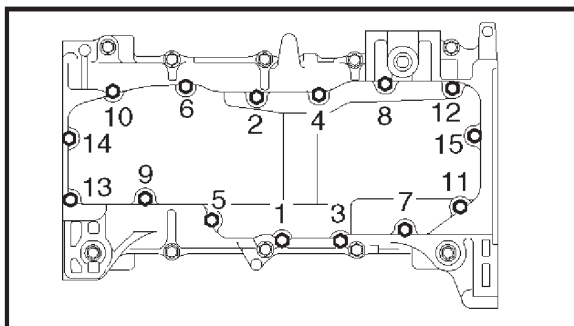
- Crankcase bolts ⑪—⑳

**NOTE:**

Tighten the bolts in the tightening sequence cast on the crankcase.



**Crankcase bolt ⑪—⑳:**  
12 N • m (1.2 kgf • m, 8.7 ft • lb)



## 7. Tighten:

- Oil pan bolts

**NOTE:**

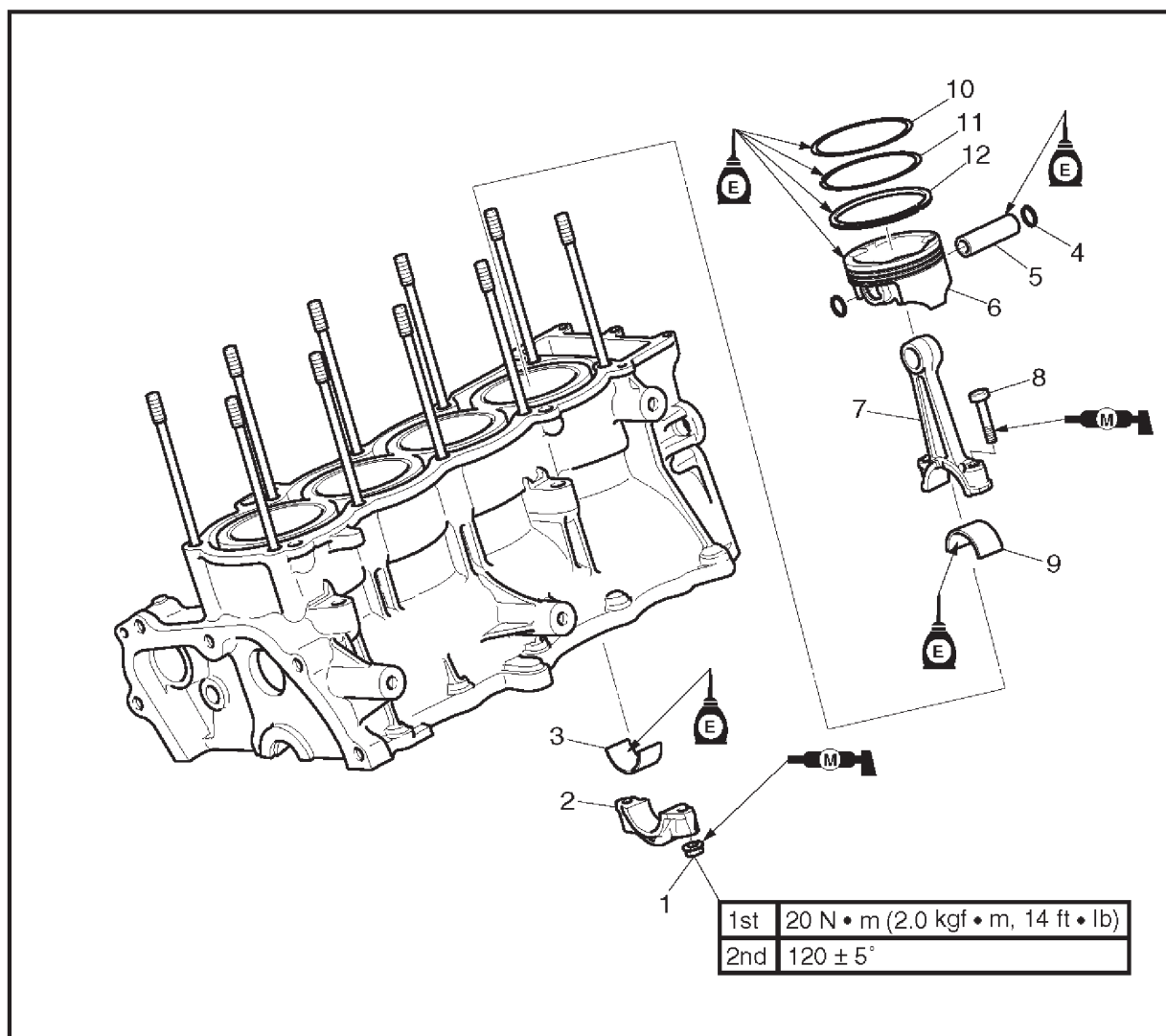
Tighten the bolts in the tightening sequence cast on the oil pan.



**Oil pan bolt:**  
12 N • m (1.2 kgf • m, 8.7 ft • lb)  
LOCTITE 572



## CONNECTING RODS AND PISTONS EXPLODED DIAGRAM

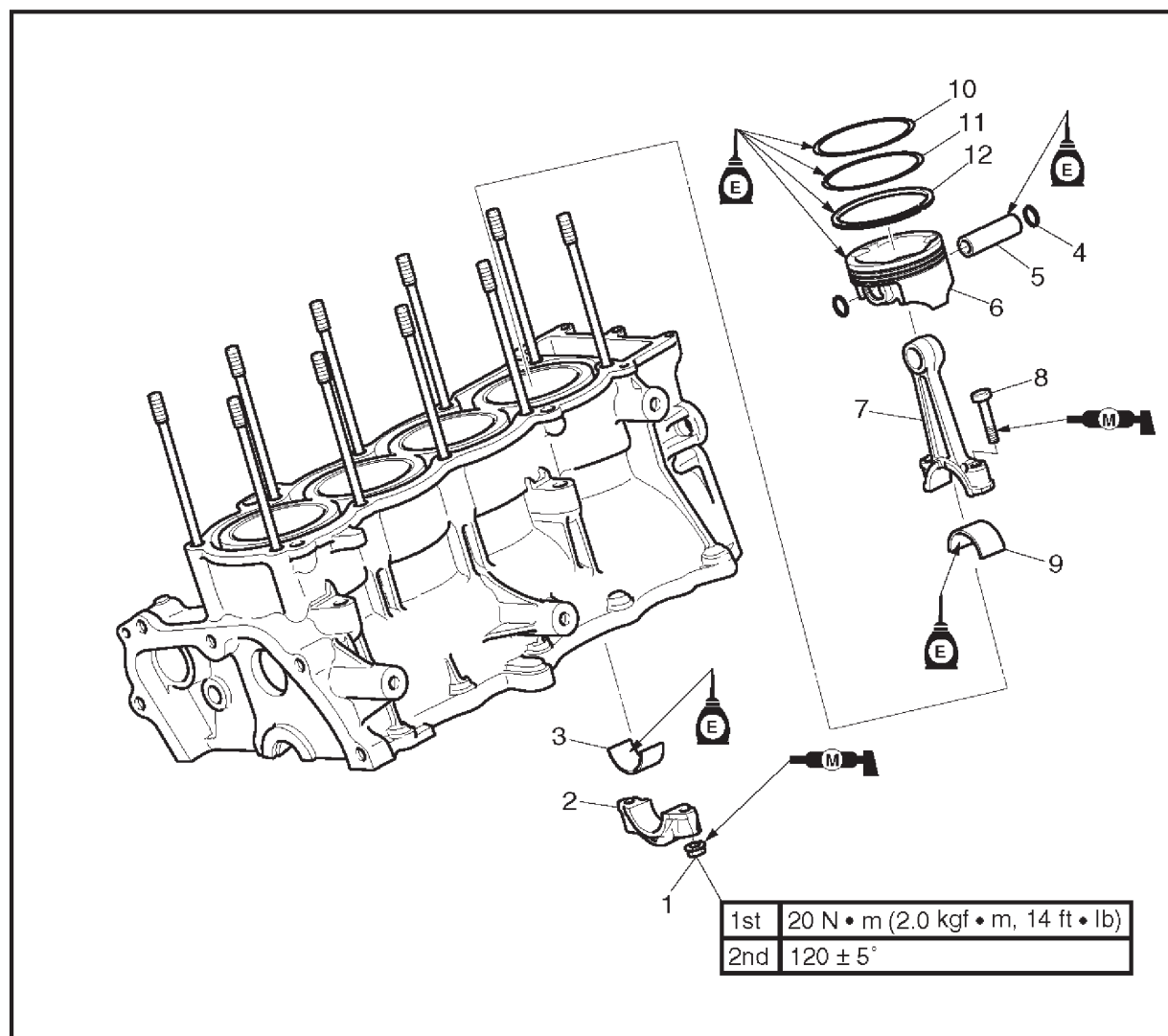


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>CONNECTING RODS AND PISTONS REMOVAL</b>		Follow the left "Step" for removal.
	Crankcase		Separate Refer to "CRANKCASE".
1	Nut	8	<b>Not reusable</b>
2	Connecting rod cap	4	
3	Big end lower bearing	4	
4	Piston pin clip	8	<b>Not reusable</b>
5	Piston pin	4	
6	Piston	4	
7	Connecting rod	4	



## CONNECTING RODS AND PISTONS (Cont'd.) EXPLODED DIAGRAM

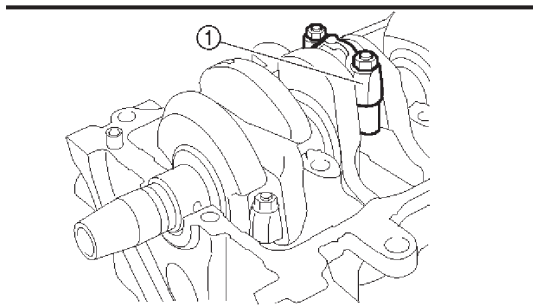


Step	Procedure/Part name	Q'ty	Service points
8	Bolt	8	<div>Not reusable</div>     Reverse the removal steps for installation.
9	Big end upper bearing	4	
10	Top ring	4	
11	2nd ring	4	
12	Oil ring	4	





## CONNECTING RODS AND PISTONS (Cont'd.)



### SERVICE POINTS

#### Connecting rod and piston removal

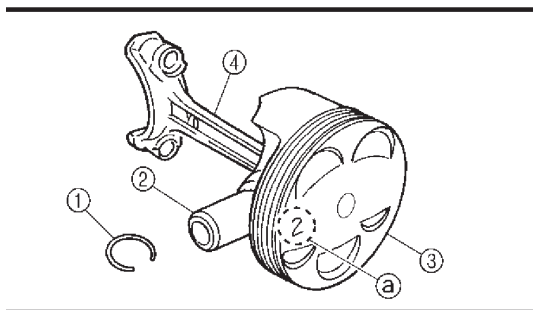
The following procedure applies to all of the connecting rods and pistons.

1. Remove:

- Connecting rod cap ①
- Big end bearings

#### NOTE:

Identify the position of each big end bearing so that it can be reinstalled in its original place.



2. Remove:

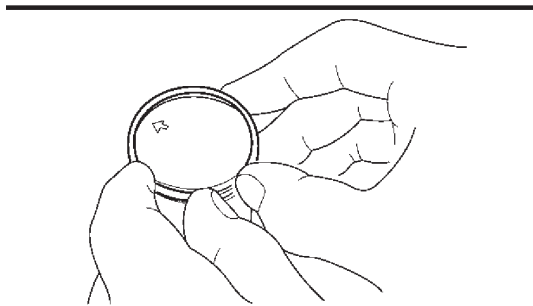
- Piston pin clips ①
- Piston pin ②
- Piston ③
- Connecting rod ④

#### CAUTION:

Do not use a hammer to drive the piston pin out.

#### NOTE:

- For reference during installation, put an identification number (a) on the piston crown.
- Before removing the piston pin, deburr the piston pin clip's groove and the piston's pin bore area.



3. Remove:

- Top ring
- 2nd ring
- Oil ring

#### NOTE:

When removing a piston ring, open the end gap with your fingers and lift the other side of the ring over the piston crown.



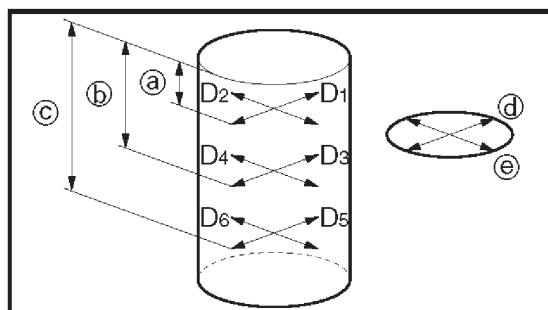
## CONNECTING RODS AND PISTONS (Cont'd.)

## Cylinder and piston inspection

The following procedure applies to all of the cylinders and pistons.

## 1. Check:

- Piston wall
  - Cylinder wall
- Vertical scratches → Replace the cylinder, and the piston and piston rings as a set.



## 2. Measure:

- Piston-to-cylinder clearance

## Measurement steps:

- Measure cylinder bore "C" with the cylinder bore gauge.

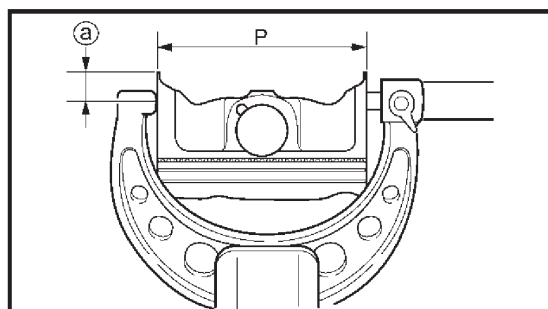
Cylinder bore "C"	76.000–76.015 mm (2.9921–2.9927 in)
Taper limit "T"	0.08 mm (0.003 in)
Out of round "R"	0.05 mm (0.002 in)

"C" = maximum of D1–D6

"T" = maximum of D1–D5 (direction (d)) and D2–D6 (direction (e))

"R" = maximum of D2–D1 (measuring point (a)) and D6–D5 (measuring point (c))

- If out of specification, replace the cylinder, and the piston and piston rings as a set.
  - Measure piston skirt diameter "P" with the micrometer.
- (a) 5 mm (0.2 in) from the bottom edge of the piston



	Piston size "P"
Standard	75.895–75.910 mm (2.9880–2.9986 in)



## CONNECTING RODS AND PISTONS (Cont'd.)

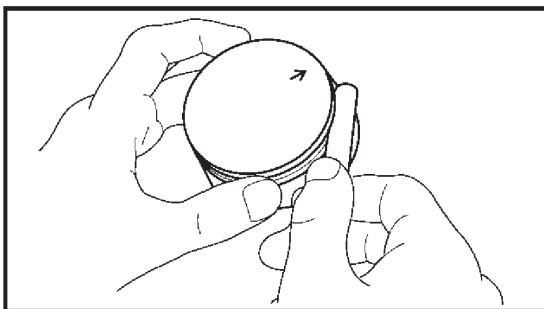
- If out of specification, replace the piston and piston rings as a set.
- Calculate the piston-to-cylinder clearance with the following formula.

**Piston-to-cylinder clearance = Cylinder bore "C" – Piston skirt diameter "P"**



**Piston-to-cylinder clearance:**  
0.10–0.11 mm (0.0039–0.0043 in)  
<Limit>: 0.17 mm (0.0067 in)

- If out of specification, replace the piston and piston rings as a set.

**Piston ring inspection**

## 1. Measure:

- Piston ring side clearance  
Out of specification → Replace the piston and piston rings as a set.

**NOTE:**

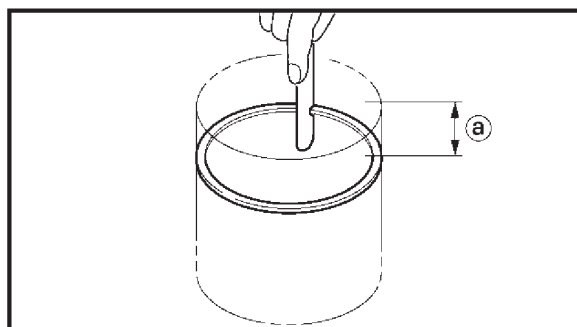
Before measuring the piston ring side clearance, eliminate any carbon deposits from the piston ring grooves and piston rings.



**Side clearance:**  
**Top ring:**  
0.030–0.065 mm  
(0.0012–0.0026 in)  
**2nd ring:**  
0.020–0.055 mm  
(0.0008–0.0022 in)  
**Oil ring:**  
0.040–0.160 mm  
(0.0016–0.0063 in)



## CONNECTING RODS AND PISTONS (Cont'd.)



## 2. Install:

- Piston ring  
(into the cylinder)

**NOTE:**

Level the piston ring in the cylinder with the piston crown.

① 5 mm (0.2 in)

## 3. Measure:

- Piston ring end gap  
Out of specification → Replace the piston ring.

**NOTE:**

The oil ring expander spacer's end gap cannot be measured. If the oil ring rail's gap is excessive, replace all three piston rings.

**Piston ring end gap:****Top ring:**

0.32–0.44 mm  
(0.0126–0.0173 in)

**2nd ring:**

0.43–0.58 mm  
(0.0169–0.0228 in)

**Oil ring:**

0.10–0.35 mm  
(0.0039–0.0138 in)



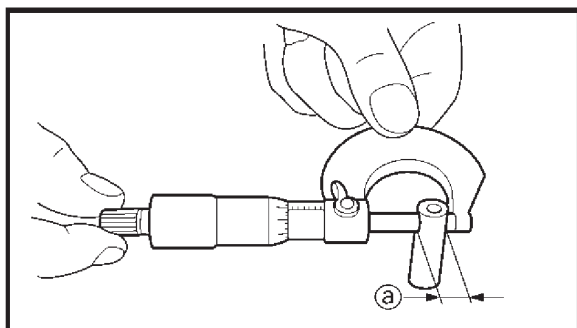
## CONNECTING RODS AND PISTONS (Cont'd.)

### Piston pin inspection

The following procedure applies to all of the piston pins.

#### 1. Check:

- Piston pin  
Blue discoloration/grooves → Replace the piston pin and then check the lubrication system.

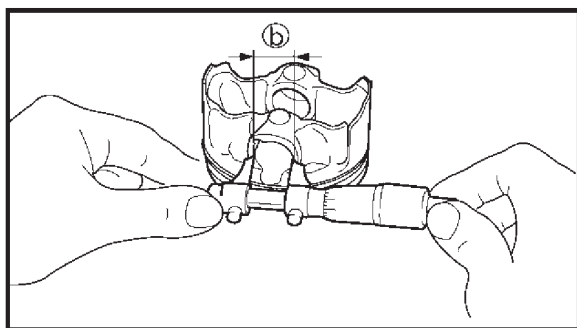


#### 2. Measure:

- Piston pin outside diameter ①  
Out of specification → Replace the piston pin.



**Piston pin outside diameter:**  
16.991–17.000 mm  
(0.6689–0.6693 in)  
<Limit>: 16.98 mm (0.67 in)



#### 3. Measure:

- Piston pin bore diameter (in the piston) ②  
Out of specification → Replace the piston.



**Piston pin bore diameter  
(in the piston):**  
17.002–17.013 mm  
(0.6693–0.6698 in)

#### 4. Calculate:

- Piston-pin-to-piston clearance  
Out of specification → Replace the piston pin.

**Piston-pin-to-piston clearance =**  
**Piston pin bore diameter (in the piston)**  
**② – Piston pin outside diameter ①**



**Piston-pin-to-piston clearance:**  
0.002–0.022 mm  
(0.0001–0.0009 in)



## CONNECTING RODS AND PISTONS (Cont'd.)

## Connecting rod inspection

## 1. Measure:

- Crankshaft-pin-to-big-end-bearing clearance

Out of specification → Replace the big end bearings.



**Crankshaft-pin-to-big-end-bearing clearance:**  
0.016–0.040 mm  
(0.0006–0.0016 in)

**Measurement steps:**

The following procedure applies to all of the connecting rods.

**CAUTION:**

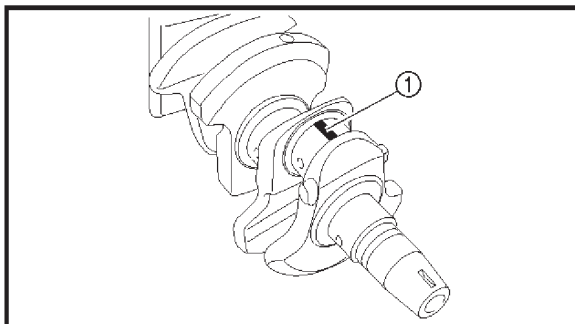
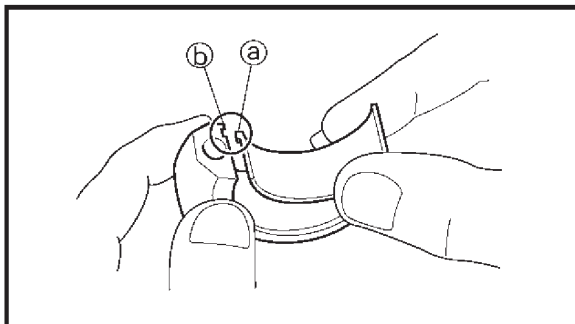
**Do not interchange the big end bearings and connecting rods. To obtain the correct crankshaft-pin-to-big-end-bearing clearance and prevent engine damage, the big end bearings must be installed in their original positions.**

- Clean the big end bearings, crankshaft pins, and the inside of the connecting rod halves.
- Install the big end upper bearing into the connecting rod and the big end lower bearing into the connecting rod cap.

**NOTE:**

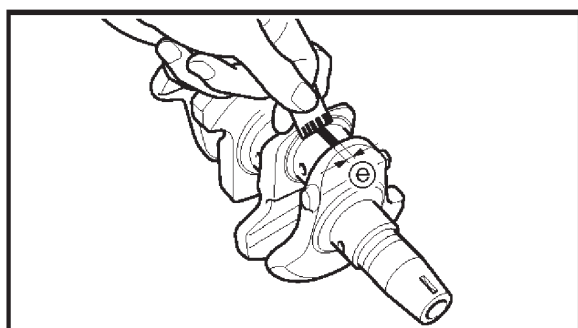
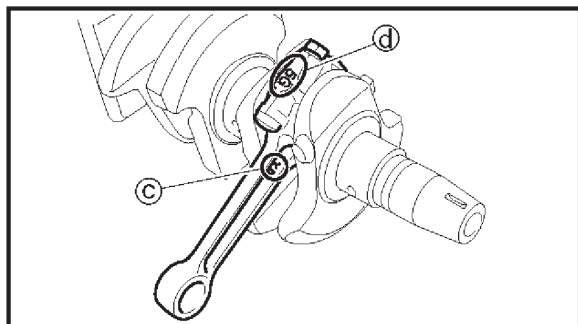
Align the projections (a) on the big end bearings with the notches (b) in the connecting rod and connecting rod cap.

- Put a piece of Plastigauge (1) on the crankshaft pin.
- Assemble the connecting rod halves.



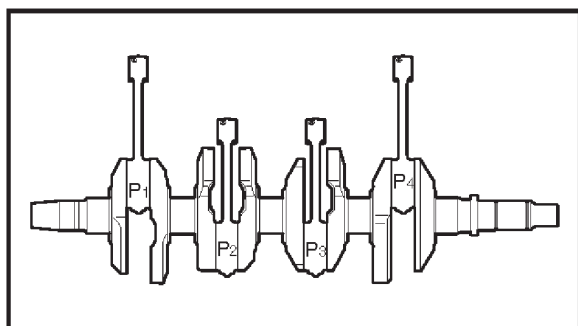


## CONNECTING RODS AND PISTONS (Cont'd.)

**NOTE:**

- Do not move the connecting rod or crankshaft until the clearance measurement has been completed.
- Lubricate the bolts threads and nut seats with molybdenum disulfide grease.
- Make sure the "Y" mark © on the connecting rod faces towards the front side of the crankshaft.
- Make sure the characters ④ on both the connecting rod and connecting rod cap are aligned.

- Tighten the connecting rod nuts. Refer to "Connecting rod and piston installation".
- Remove the connecting rod and big end bearings. Refer to "Connecting rod and piston removal".
- Measure the compressed Plastigauge width ⑥ on the crankshaft pin. If the crankshaft-pin-to-big-end-bearing clearance is out of specification, select replacement big end bearings.



## 2. Select:

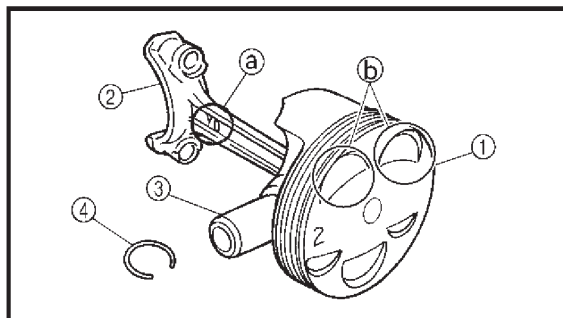
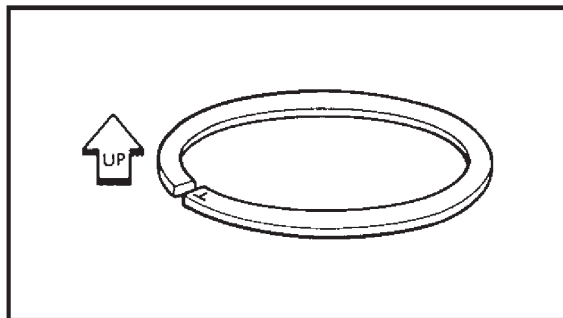
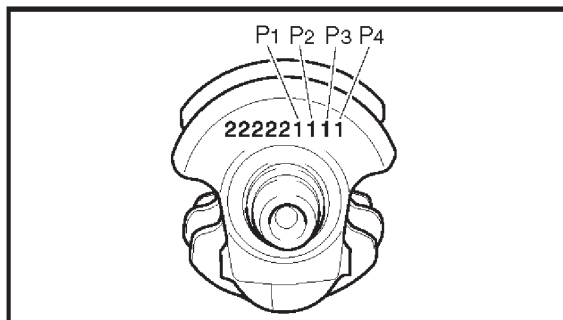
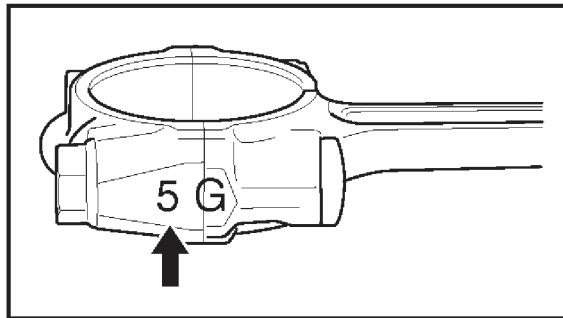
- Big end bearings (P1–P4)

**NOTE:**

- The numbers stamped into the crankshaft web and the numbers on the connecting rods are used to determine the replacement big end bearing sizes.
- "P1"–"P4" refer to the bearings shown in the crankshaft illustration.



## CONNECTING RODS AND PISTONS (Cont'd.)



For example, if the connecting rod “P1” and the crankshaft web “P1” numbers are “5” and “1” respectively, then the bearing size for “P1” is:

**Bearing size of P1:**

“P1” (connecting rod) –

“P1” (crankshaft web)

$$5 - 1 = 4 \text{ (green)}$$

**BEARING COLOR CODE**

1	brown
2	black
3	blue
4	green

**Connecting rod and piston installation**

The following procedure applies to all of the pistons and connecting rods.

## 1. Install:

- Oil ring
- 2nd ring
- Top ring

**NOTE:**

Be sure to install the piston rings so that the manufacturer's marks or numbers face up.

## 2. Install:

- Piston ①
- Connecting rod ②
- Piston pin ③
- Piston pin clips ④

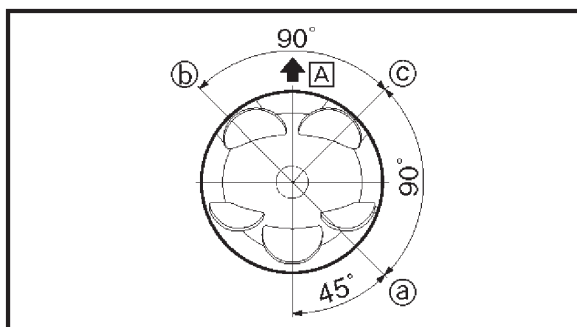
**NOTE:**

- Apply engine oil onto the piston pin.
- When installing the connecting rod to the piston, make sure that the “Y” mark ② on the connecting rod faces towards the left when the exhaust valve recesses ③ on the piston face upward. Refer to the illustration.
- Reinstall each piston into its original cylinder (numbering order starting from the front: #1 to #4).





## CONNECTING RODS AND PISTONS (Cont'd.)



### 3. Offset:

- Piston ring end gaps

- Ⓐ Top ring, oil ring expander spacer
- Ⓑ 2nd ring, lower oil ring rail
- Ⓒ Upper oil ring rail
- Ⓐ Exhaust side

### 4. Lubricate:

- Piston
  - Piston rings
  - Cylinder
- (with the recommended lubricant)



**Recommended lubricant:**  
Engine oil

### 5. Lubricate:

- Bolt threads
  - Nut seats
- (with the recommended lubricant)



**Recommended lubricant:**  
Molybdenum disulfide grease

### 6. Lubricate:

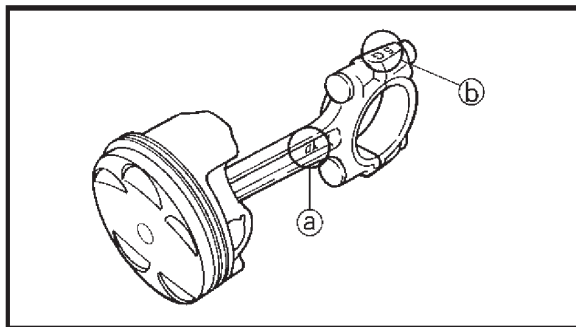
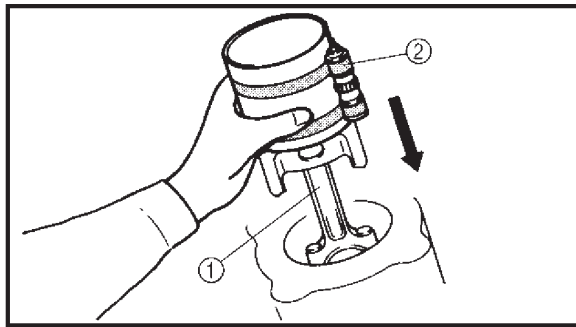
- Crankshaft pins
  - Big end bearings
  - Connecting rod inner surface
- (with the recommended lubricant)



**Recommended lubricant:**  
Engine oil



## CONNECTING RODS AND PISTONS (Cont'd.)



## 7. Install:

- Big end bearings
- Connecting rod assembly ①  
(into the cylinder and onto the crankshaft pin)
- Connecting rod cap  
(onto the crankshaft pin)

**NOTE:**

- Align the projections on the big end bearings with the notches in the connecting rods and connecting rod caps.
- Be sure to reinstall each big end bearing in its original place.
- While compressing the piston rings with piston ring compressor ②, install the connecting rod assembly into the cylinder with the other hand.
- Make sure the “Y” marks ① on the connecting rods face towards the front side of the crankshaft.
- Make sure the characters ② on both the connecting rod and connecting rod cap are aligned.



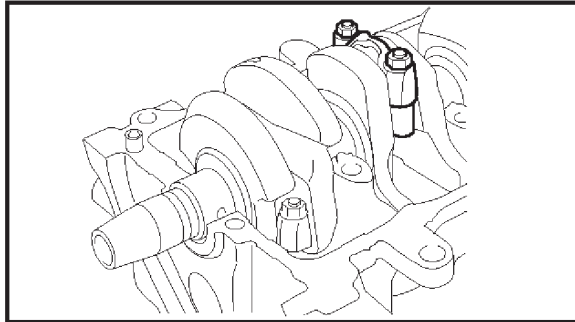
**Piston ring compressor:**  
**YM-08037/90890-05158**

## 8. Align:

- Bolt heads  
(with the connecting rod)



## CONNECTING RODS AND PISTONS (Cont'd.)



9. Tighten:

- Connecting rod nuts

**⚠ WARNING**

- Replace the connecting rod bolts and nuts with new ones.
- Clean the connecting rod bolts and nuts.

**NOTE:**

The tightening procedure of the connecting rod nuts is angle controlled, therefore tighten the nuts using the following procedure.

**Tightening steps:**

- Tighten the connecting rod nuts to the specified torque.

**Connecting rod nut:****1st:****20 N • m (2.0 kgf • m, 14 ft • lb)**

- Tighten the connecting rod nuts further to reach the specified angle 120°.

**Connecting rod nut:****Final:****Specified angle 120 ± 5°****⚠ WARNING**

When the nuts are tightened more than the specified angle, do not loosen the nut and then retighten it.

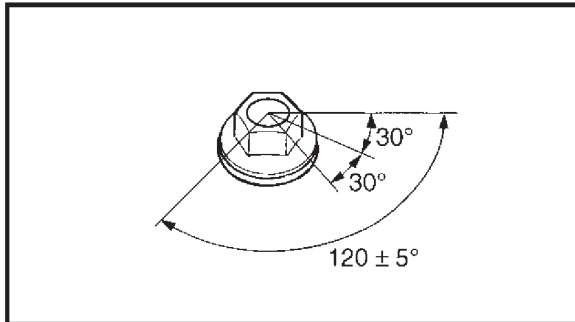
Replace the bolt and nut with a new one and perform the procedure again.

**CAUTION:**

- Do not use a torque wrench to tighten the nut to the specified angle.
- Tighten the nut until it is at the specified angle.

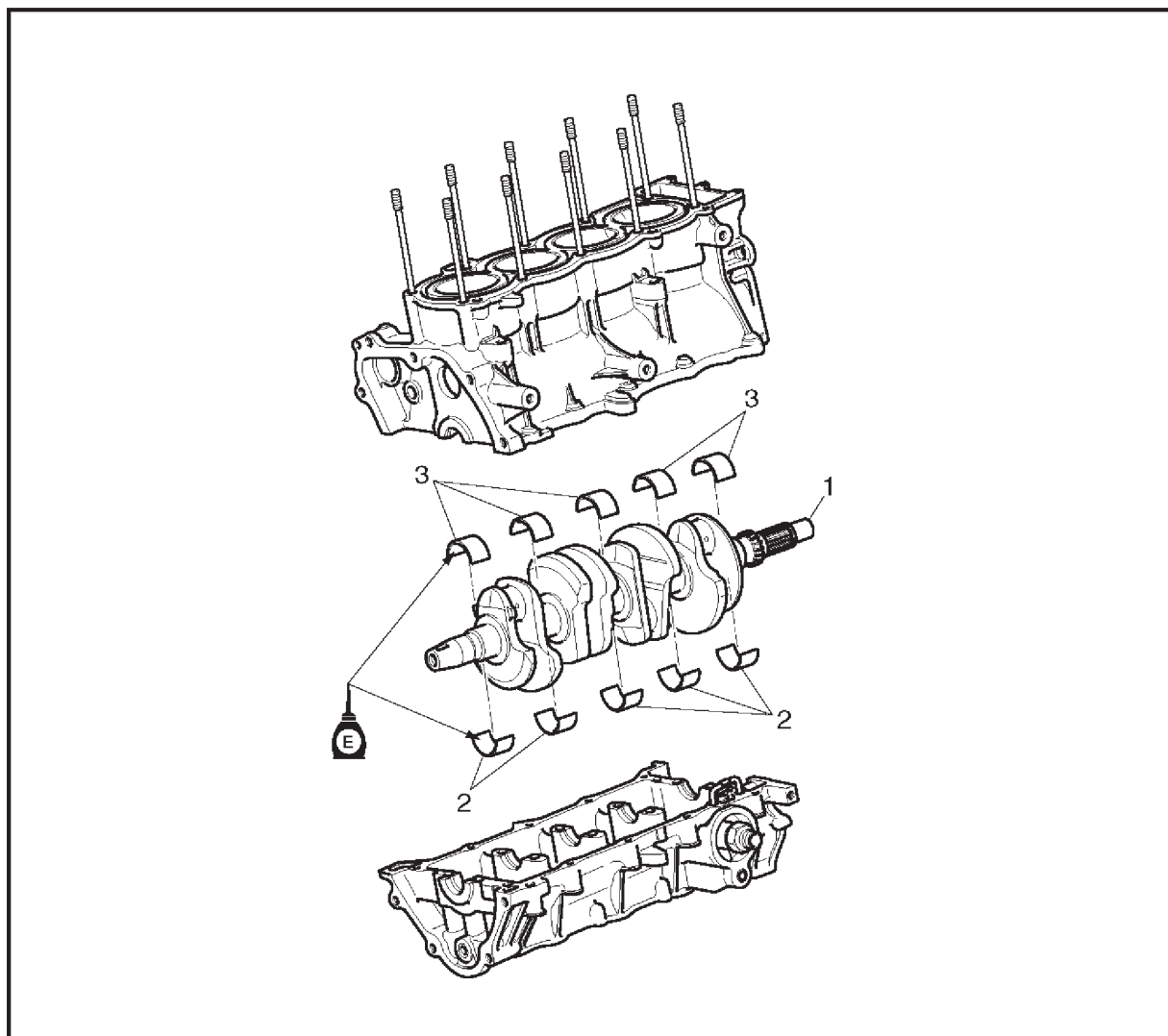
**NOTE:**

When using a hexagonal nut, note that the angle from one corner to another is 60°.





## CRANKSHAFT EXPLODED DIAGRAM

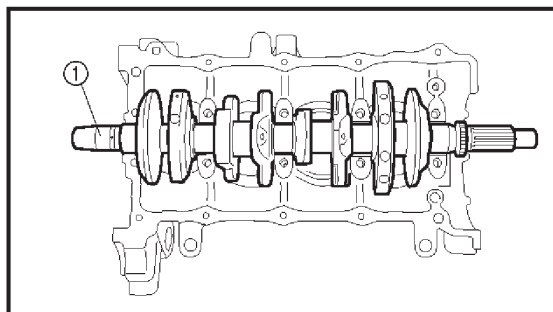


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>CRANKSHAFT REMOVAL</b>		
	Crankcase		Follow the left "Step" for removal.
	Connecting rod caps		Separate Refer to "CRANKCASE".
1	Crankshaft	1	Refer to "CONNECTING RODS AND PISTONS".
2	Crankshaft journal lower bearing	5	
3	Crankshaft journal upper bearing	5	
			Reverse the removal steps for installation.



## CRANKSHAFT (Cont'd.)



### SERVICE POINTS

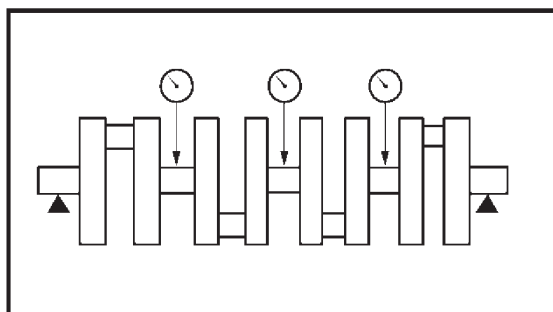
#### Crankshaft removal

##### 1. Remove:

- Crankshaft ①
- Crankshaft journal lower bearings (from the lower crankcase)
- Crankshaft journal upper bearings (from the upper crankcase)

#### NOTE:

Identify the position of each crankshaft journal bearing so that it can be reinstalled in its original place.



#### Crankshaft inspection

##### 1. Measure:

- Crankshaft runout  
Out of specification → Replace the crankshaft.



**Maximum crankshaft runout:**  
0.03 mm (0.0012 in)

##### 2. Check:

- Crankshaft journal surfaces
- Crankshaft pin surfaces  
Scratches/wear → Replace the crankshaft.
- Bearing surfaces  
Scratches/wear → Replace the crankshaft journal bearing.

##### 3. Measure:

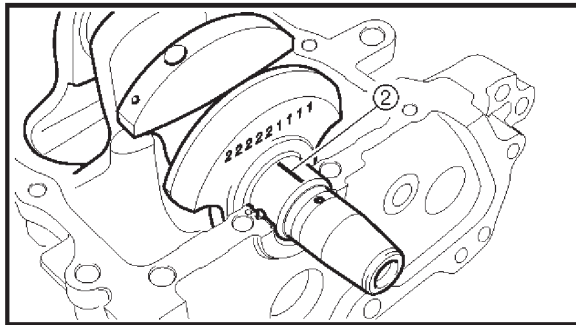
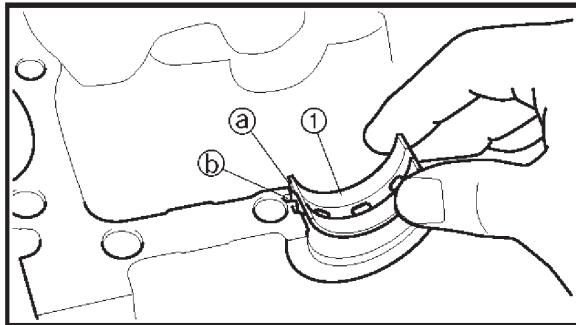
- crankshaft-journal-to-crankshaft-journal-bearing clearance  
Out of specification → Replace the crankshaft journal bearings.



**Crankshaft-journal-to-crankshaft-journal-bearing clearance:**  
0.004–0.028 mm  
(0.0002–0.0011 in)



## CRANKSHAFT (Cont'd.)

**CAUTION:**

Do not interchange the crankshaft journal bearings. To obtain the correct crankshaft-journal-to-crankshaft-journal-bearing clearance and prevent engine damage, the crankshaft journal bearings must be installed in their original positions.

**Measurement steps:**

- Clean the crankshaft journal bearings, crankshaft journals, and bearing portions of the crankcase.
- Place the upper crankcase upside down on a bench.
- Install the crankshaft journal upper bearings ① and the crankshaft into the upper crankcase.

**NOTE:**

Align the projections ① of the crankshaft journal upper bearings with the notches ② in the upper crankcase.

- Put a piece of Plastigauge ② on each crankshaft journal.

**NOTE:**

Do not put the Plastigauge over the oil hole in the crankshaft journal.

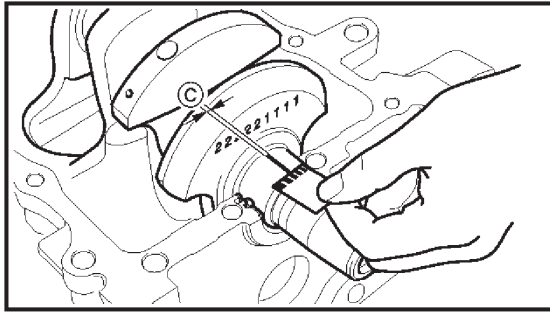
- Install the crankshaft journal lower bearings into the lower crankcase and assemble the crankcase halves.

**NOTE:**

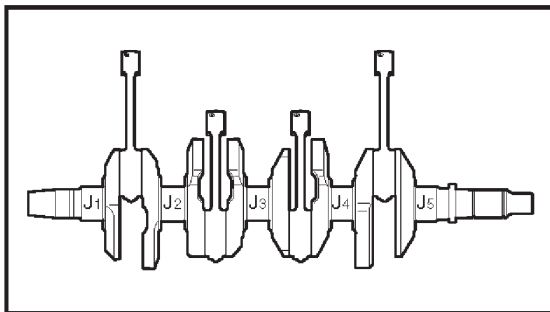
- Align the projections ① of the crankshaft journal lower bearings with the notches ② in the lower crankcase.
- Do not move the crankshaft until the clearance measurement has been completed.



## CRANKSHAFT (Cont'd.)



- Tighten the bolts to specification in the tightening sequence cast on the crankcase.  
Refer to "Crankcase assembly"—"CRANKCASE".
- Remove the lower crankcase and the crankshaft journal lower bearings.
- Measure the compressed Plastigauge width © on each crankshaft journal.  
If the crankshaft-journal-to-crankshaft-journal-bearing clearance is out of specification, select replacement crankshaft journal bearings.

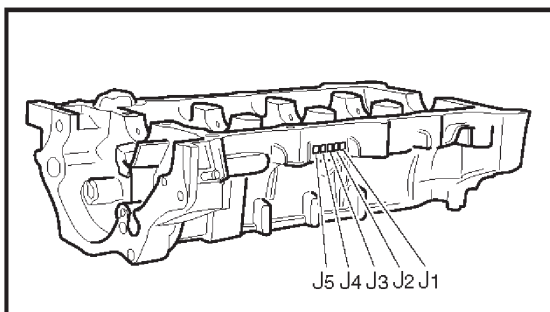


## 4. Select:

- Crankshaft journal bearings (J1–J5)

**NOTE:**

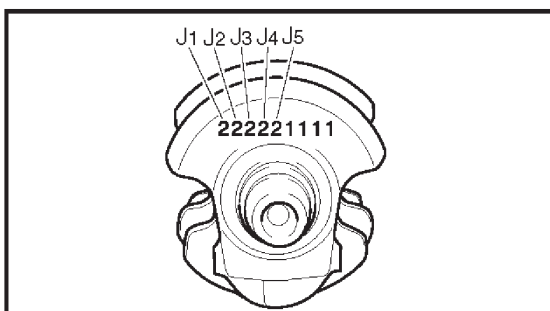
- The numbers stamped into the crankshaft web and the numbers stamped into the lower crankcase are used to determine the replacement crankshaft journal bearing sizes.
- "J1–J5" refer to the bearings shown in the crankshaft illustration.
- If "J1–J5" are the same, use the same size for all of the bearings.



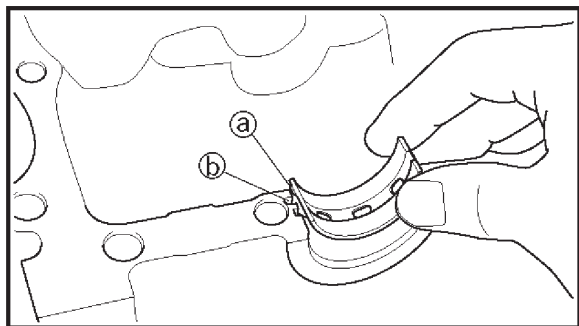
For example, if the crankcase "J1" and crankshaft web "J1" numbers are "5" and "2" respectively, then the bearing size for "J1" is:

**Bearing size of J1:**

"J1" (crankcase) – "J1" (crankshaft web)  
5 – 2 = 3 (blue)

**BEARING COLOR CODE**

1	brown
2	black
3	blue
4	green
5	yellow

**CRANKSHAFT (Cont'd.)****Crankshaft Installation****1. Install:**

- Crankshaft journal upper bearings (into the upper crankcase)
- Crankshaft journal lower bearings (into the lower crankcase)

**NOTE:**

- Align the projections (a) on the crankshaft journal upper bearings with the notches (b) in the upper crankcase.
- Be sure to install each crankshaft journal bearing in its original place.

**2. Lubricate:**

- Crankshaft pins
- Connecting rod inner surface (with the recommended lubricant)

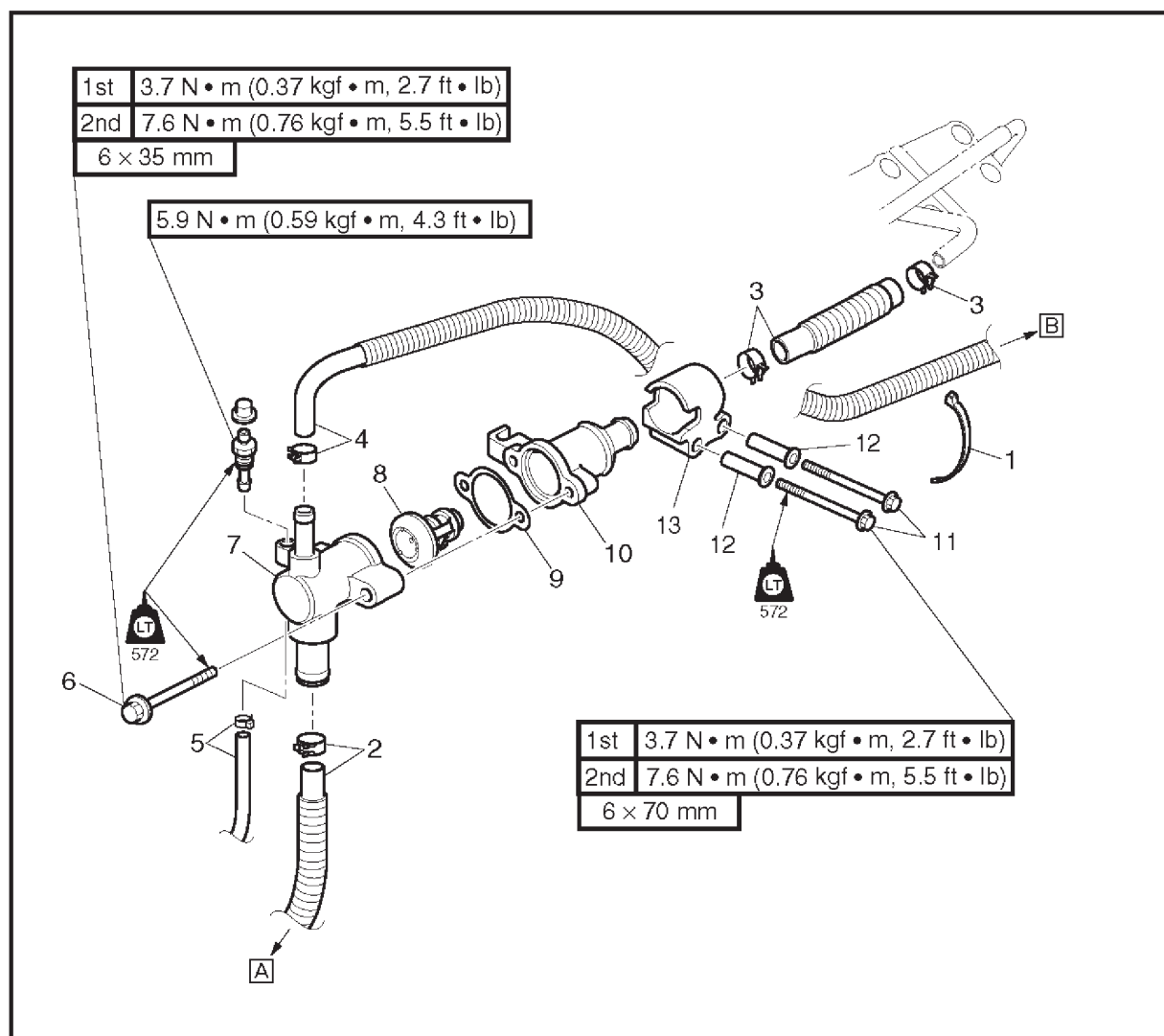


**Recommended lubricant:**  
**Engine oil**





## THERMOSTAT EXPLODED DIAGRAM

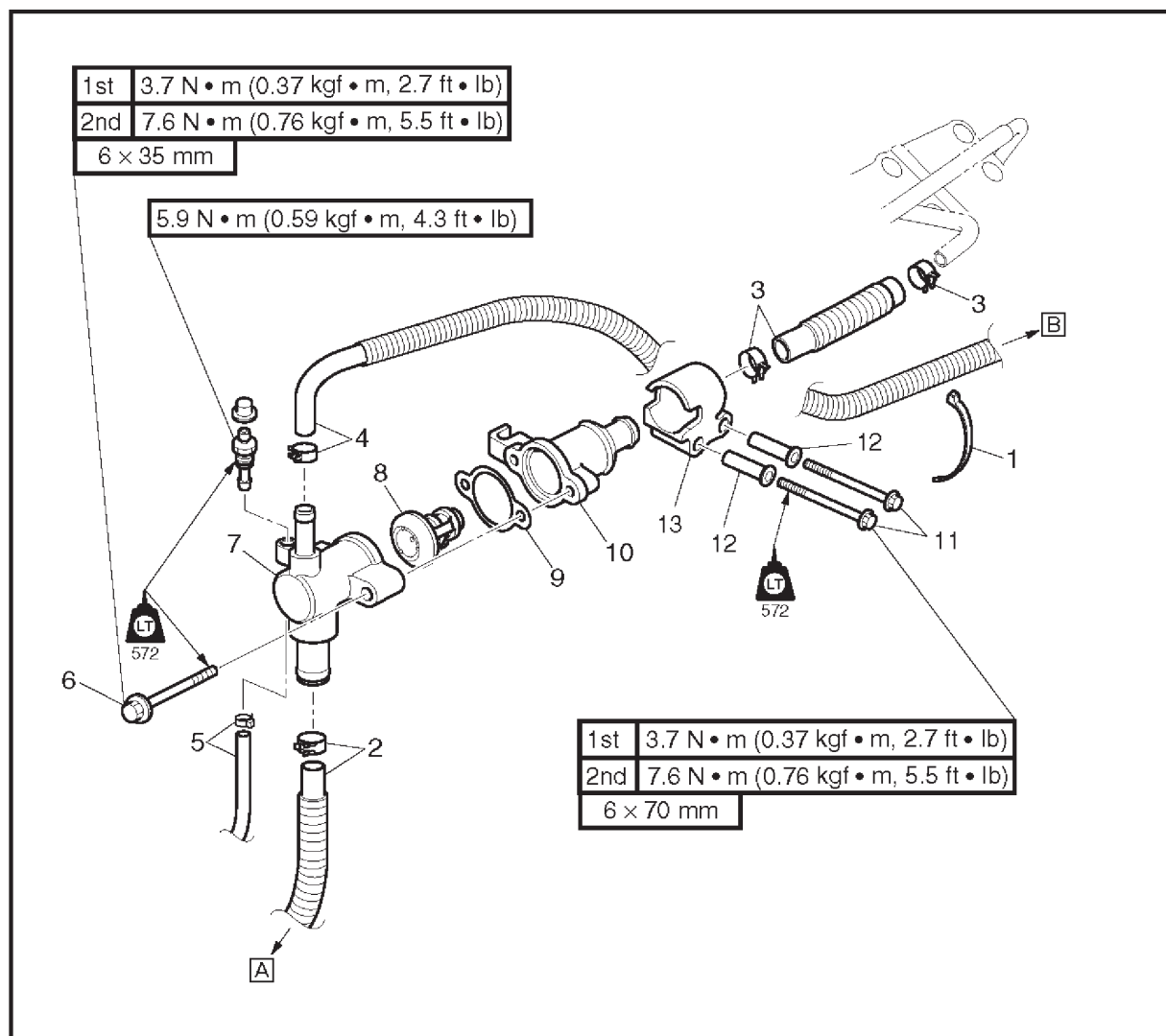


## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>THERMOSTAT REMOVAL</b>		Follow the left "Step" for removal.
1	Band	1	
2	Clamp/cooling water hose	1/1	[A] For cooling water outlet on stern side.
3	Clamp/cooling water hose	2/1	
4	Clamp/cooling water hose	1/1	[B] For cooling water pilot outlet on starboard side.
5	Band/grease hose	1/1	
6	Bolt	2	
7	Thermostat housing cover	1	
8	Thermostat	1	



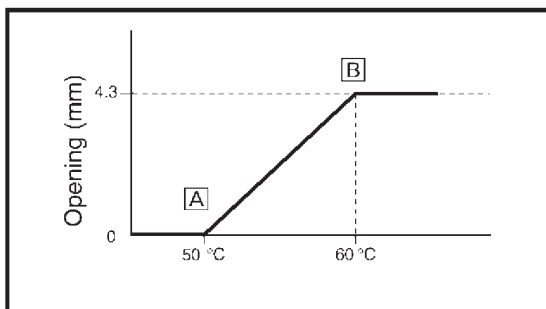
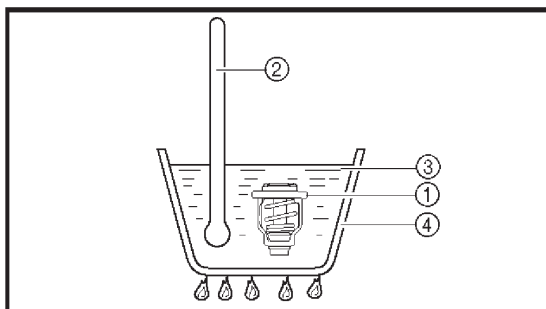
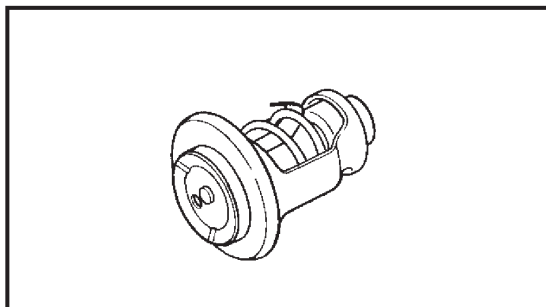
# THERMOSTAT (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
9	Gasket	1	<div>Not reusable</div>
10	Thermostat housing	1	
11	Bolt	2	
12	Collar	2	
13	Thermostat housing holder	1	
			Reverse the removal steps for installation.



## THERMOSTAT (Cont'd.)



## SERVICE POINTS

## Thermostat inspection

## 1. Check:

- Thermostat ①
- Does not open at 50–60 °C (123–141 °F) → Replace.

## Checking steps:

- Suspend the thermostat in a container filled with water.
- Slowly heat the water.
- Place a thermometer in the water.
- While stirring the water, observe the thermostat and thermometer's indicated temperature.

- ① Thermostat
- ② Thermometer
- ③ Water
- ④ Container
- A Fully closed
- B Fully open

## NOTE:

If the accuracy of the thermostat is in doubt, replace it. A faulty thermostat could cause serious overheating or over cooling.

## 2. Check:

- Thermostat housing cover
- Thermostat housing
- Cracks/damage → Replace.

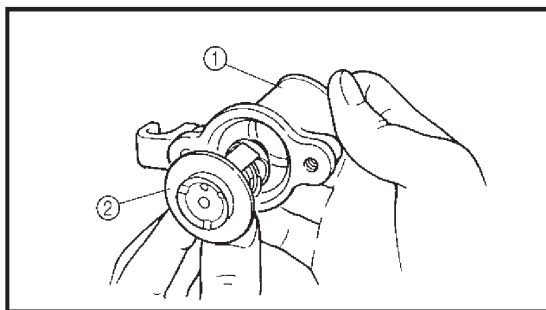
## 3. Check:

- Cooling system
- Leaks → Repair or replace any faulty part.

## Thermostat installation

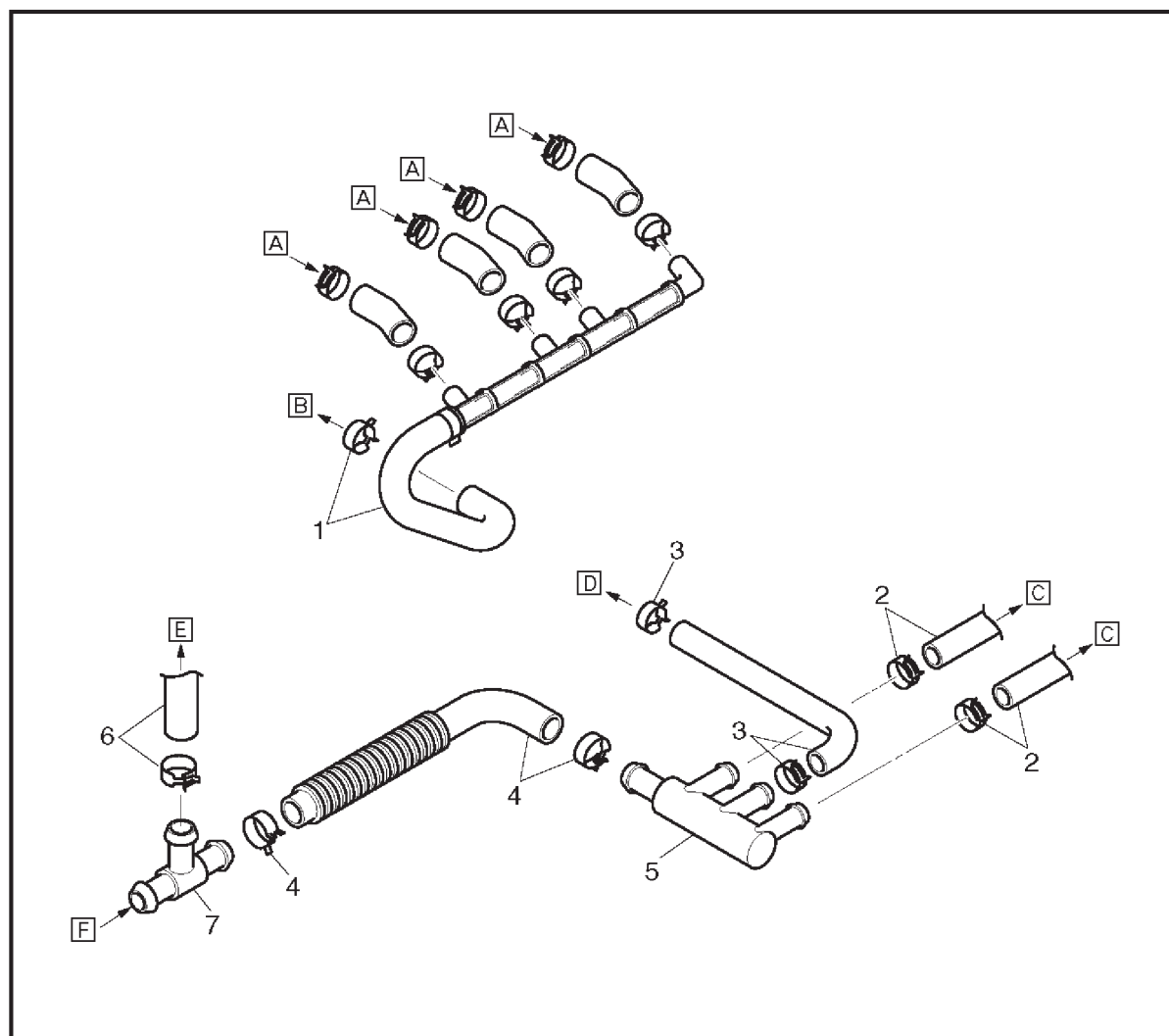
## 1. Install:

- Thermostat housing ①
- Thermostat ②
- Gasket
- Thermostat housing cover





## COOLING WATER HOSE EXPLODED DIAGRAM



## REMOVAL AND INSTALLATION CHART

Step	Procedure/Part name	Q'ty	Service points
	<b>COOLING WATER HOSE REMOVAL</b>		Follow the left "Step" for removal.
1	Exhaust manifold Clamp/cooling water hose	1/1	Refer to "EXHAUST MANIFOLD". [A] From exhaust manifold [B] To cylinder block
2	Clamp/cooling water hose	2/2	[C] To exhaust pipe
3	Clamp/cooling water hose	2/1	[D] To cylinder block
4	Clamp/cooling water hose	2/1	
5	Joint	1	
6	Clamp/cooling water hose	1/1	[E] To oil tank
7	Joint	1	[F] From cooling water inlet
			Reverse the removal steps for installation.

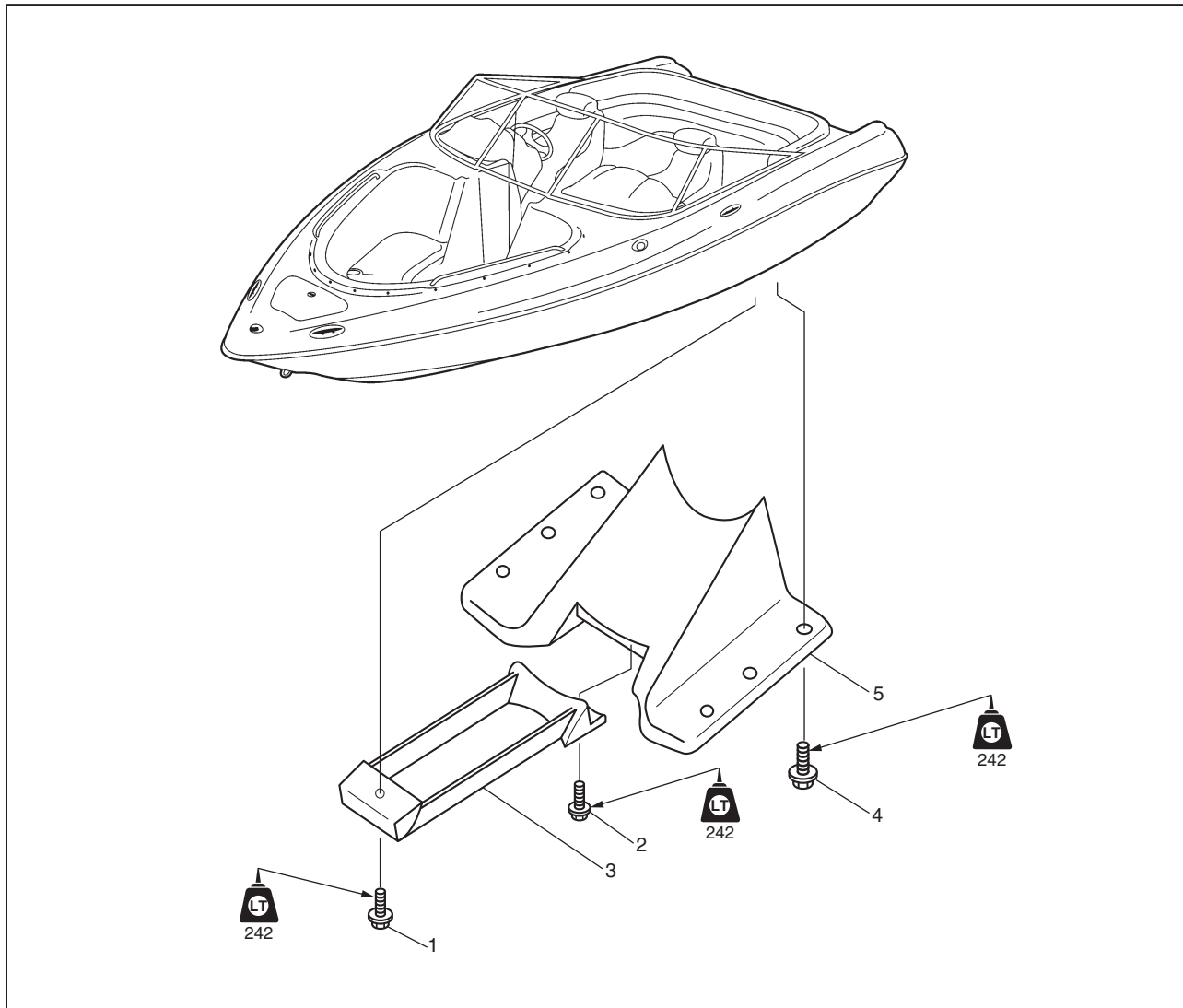
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## CHAPTER 6

### JET PUMP UNIT

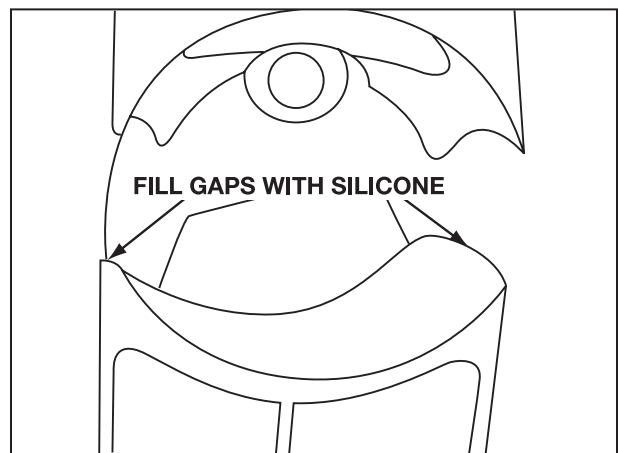
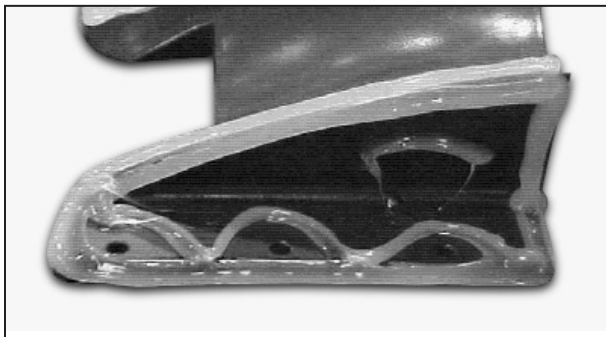
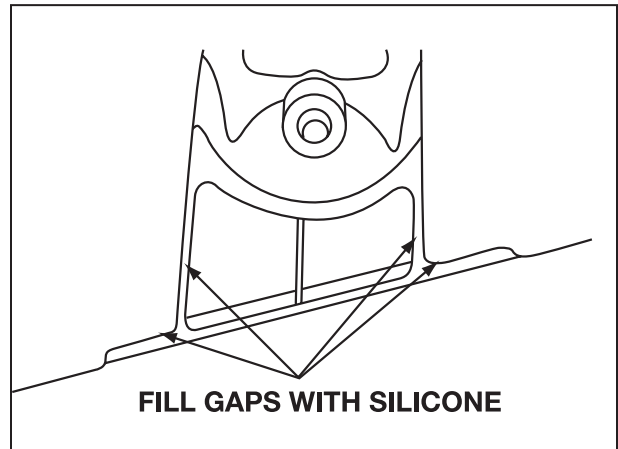
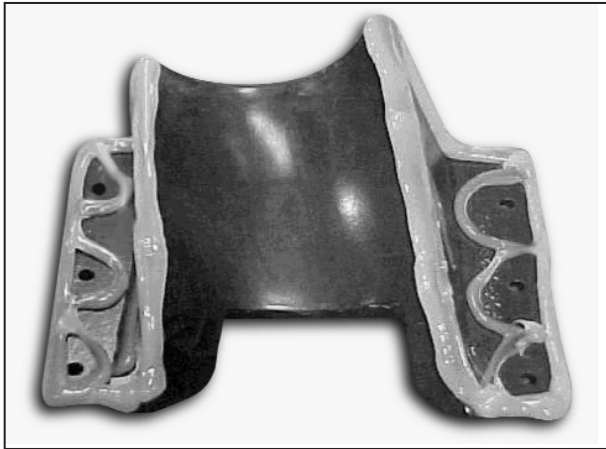
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## INTAKE GRATING EXPLODED DIAGRAM

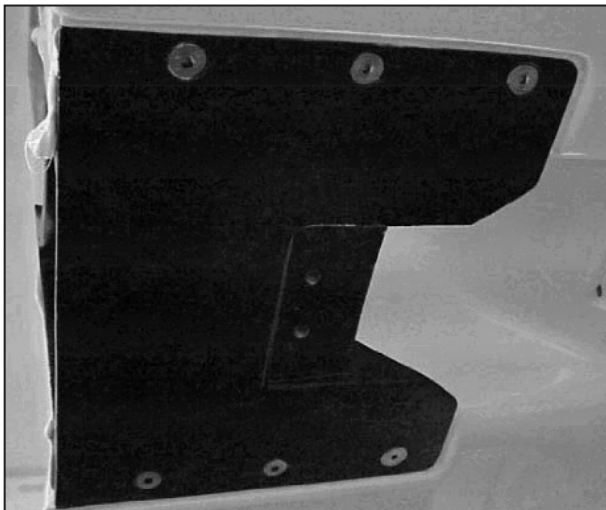


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty (ea)	Service Points
	<b>INTAKE GRATING REMOVAL</b>		Follow the left "Step" order for removal.
1	Screw	2	8 x 35mm
2	Screw	4	8 x 20mm
3	Intake Grating	2	Port and Starboard Units
4	Screw	12	8 x 40mm
5	Intake Duct	2	Port and Starboard Units
			Reverse the removal steps for installation. <b>NOTE:</b> Apply clear silicone before installing a duct into the hull.

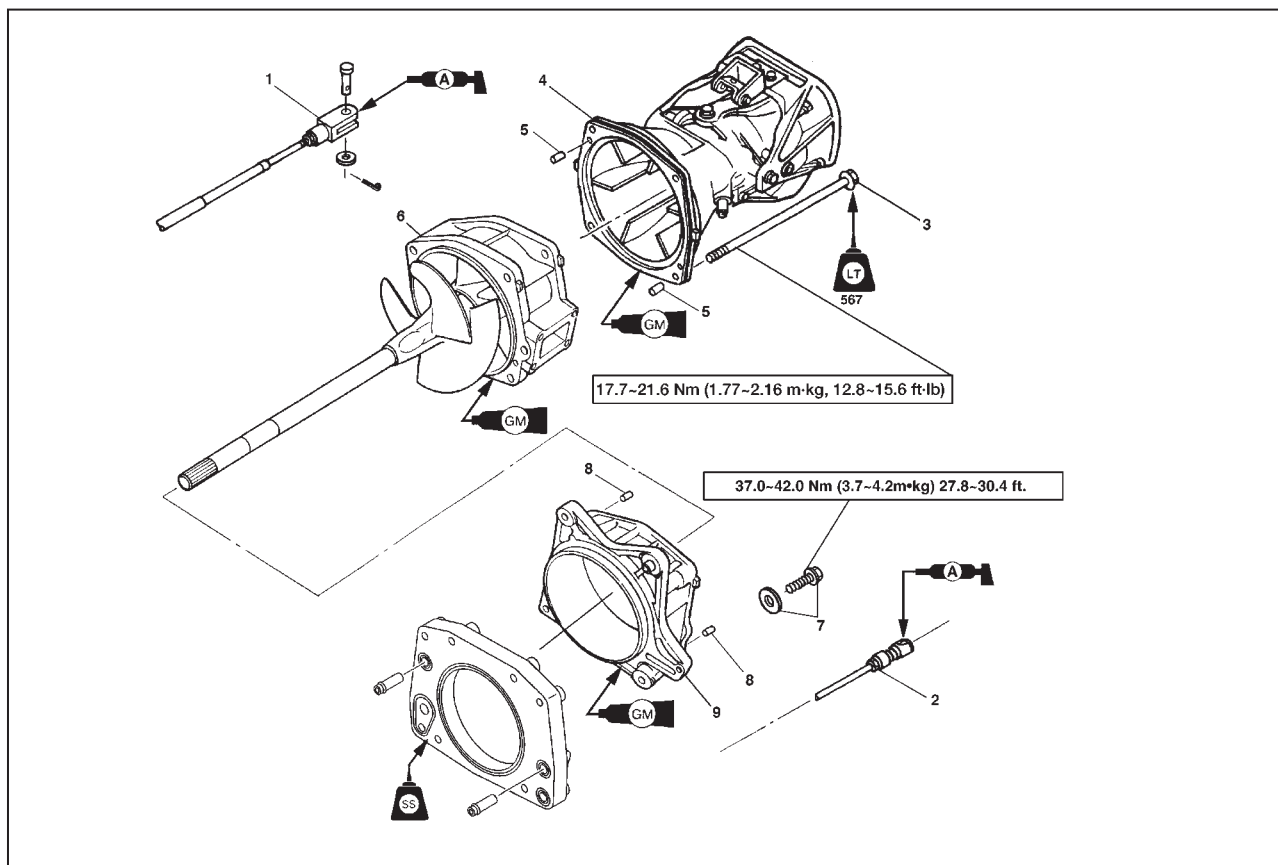


Apply clear silicone as shown before installing Duct into hull. Install Duct and torque screws to 15Nm (1.5m-kg, 11 ft-lb).





## PUMP UNIT EXPLODED DIAGRAM



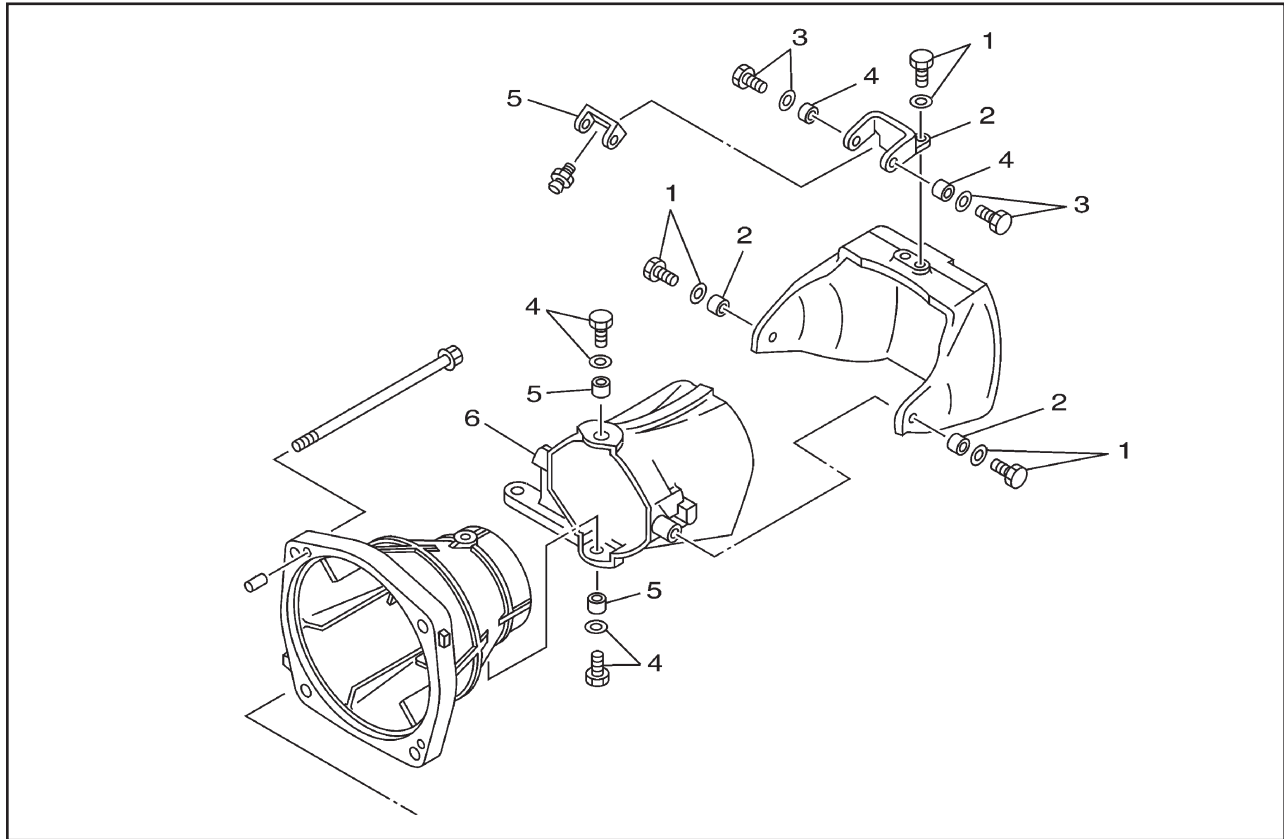
## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty (ea.)	Service Points
	<b>PUMP UNIT REMOVAL</b>		Follow the "Step" order for removal.
1	Shift Cable Joint	1	
2	Steering Cable Joint	1	
3	Bolt (with washer)	4	
4	Nozzle	1	
		1	<b>NOTE:</b> _____ May be left on to remove pump as an assembly.
5	Dowel Pin	2	
6	Duct w/Driveshaft and Impeller	1	
7	Bolt (with washer)	4	10 x 40mm
8	Dowel Pin	2	
9	Impeller Housing Assembly	1	Reverse the removal steps for installation.





## REVERSE GATE AND DEFLECTOR EXPLODED DIAGRAM

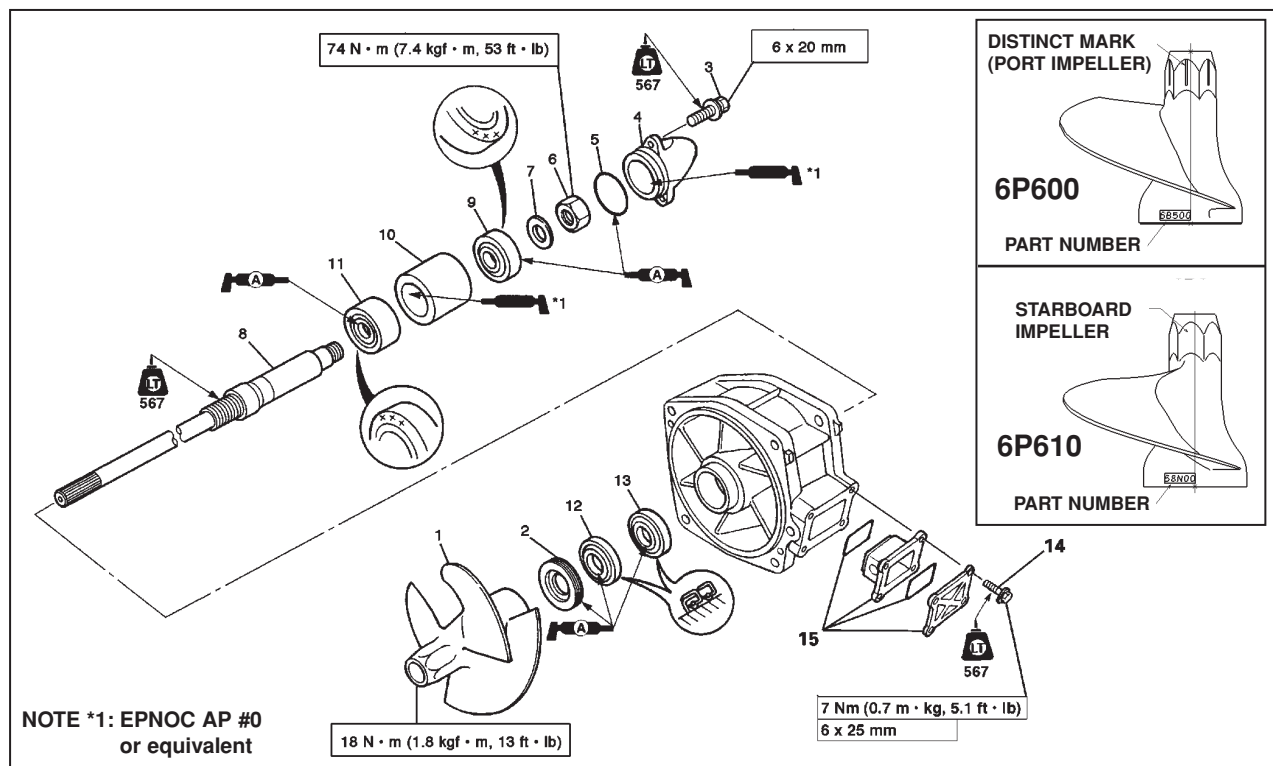


### REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty (ea)	Service Points
	<b>REVERSE GATE AND NOZZLE DEFLECTOR REMOVAL</b>		Follow the "Step" order for removal.
1	Bolt (with washer)	2	8 x 20mm
2	Collar	2	
3	Reverse Gate	1	
4	Bolt (with washer)	2	8 x 20mm
5	Collar	2	
6	Nozzle Deflector	1	
	<b>REVERSE GATE DISASSEMBLY</b>		
①	Bolt (with washer)	2	6 x 16mm
②	Gate Control Arm	1	
③	Bolt (with washer)	2	
④	Collar	2	
⑤	Swivel	1	
			Reverse the removal steps for installation.



## IMPELLER AND DRIVE SHAFT EXPLODED DIAGRAM

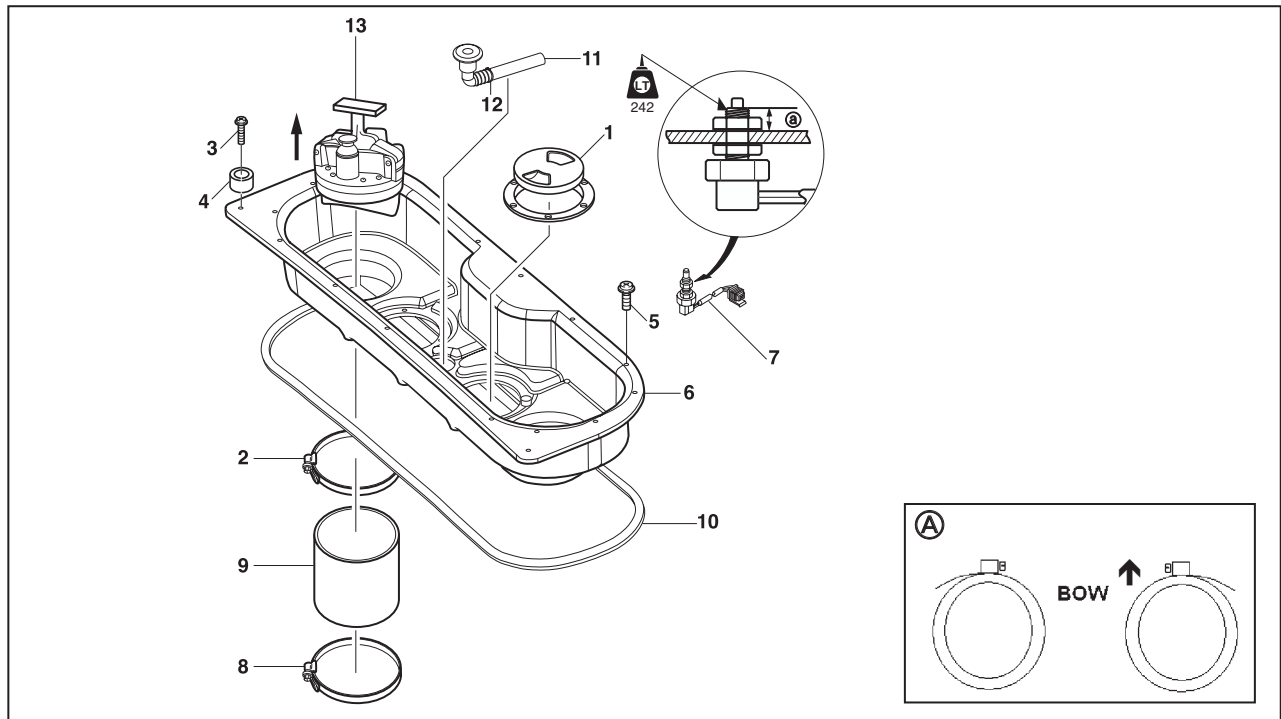


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty (ea)	Service Points
	<b>IMPELLER DUCT AND DRIVE SHAFT ASSEMBLY</b>		Follow the "Step" order for removal.
1	Impeller, Port	1	18.1° Pitch, 6P600, casting marks on hex Left-hand threads
	Impeller, Starboard	1	15.1° Pitch, 6P610, Left-hand threads
2	Spacer	1	
3	Bolt	3	
4	Cap	1	Fill cap approximately 1/3 full with EPNOC AP#0 or equivalent grease.
5	O-ring	1	
6	Nut	1	
7	Washer	1	
8	Drive shaft	1	
9	Rear Bearing	1	<b>Not reusable</b>
10	Spacer	1	
11	Front Bearing	1	<b>Not reusable</b>
12	Oil Seal	1	<b>Not reusable</b>
13	Oil Seal	1	<b>Not reusable</b>
14	Bolts	4	
15	Cover, O-rings and filter	1	
			Reverse the removal steps for installation.



## JET PUMP CLEAN-OUT PORTS EXPLODED DIAGRAM



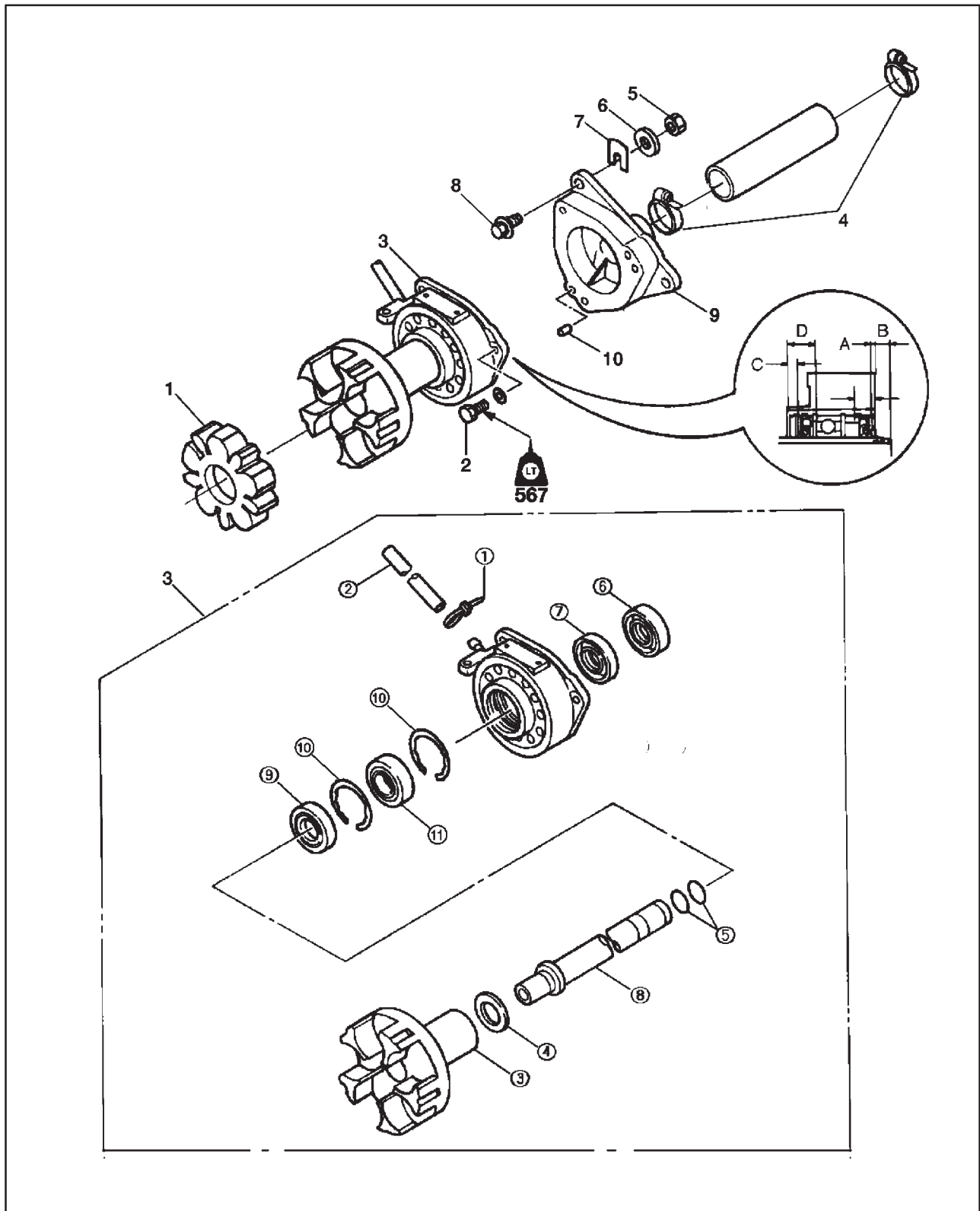
## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Qty (ea.)	Service Points
	<b>JET PUMP CLEAN-OUT TRAY REMOVAL</b>		Follow the "Step" order for removal.
1	Inspection Cover	2	
2	Clamp, Upper	2	Access top hose clamps through inner inspection holes, loosen both top clamps to remove Clean-out Tray. Clamp screw heads must be on forward (bow side) of clean-out Hose and face center of boat (See A).
3	Screw #8	4	
4	Rubber Cushion	4	
5	Screw #10	14	
6	Clean-out Tray	1	Apply silicone sealant to outside of clean-out port flanges.
7	Hatch Interlock Switch	2	Set height a = 14mm (0.55"). Apply one (1) drop of removable thread lock (LT242) to threads.
8	Clamp, lower	2	Do not need to remove unless replacing clean-out hose.
9	Hose, clean-out	2	If hose is removed, apply silicone sealant to inside of hose at bottom, remove sealant from Cap locking grooves in jet pump clean-out port.
10	Packing	1	
11	Drain Hose	1	
12	Drain Hose Clamp	1	Lift Clean-out Tray to loosen drain hose clamp and remove drain hose.
13	Cap	2	Leave Caps in place unless jet pump clean out is required.

**NOTE:** Follow Cap removal and installation instructions in JET PUMP UNIT INSPECTION," Chapter 3.



## INTERMEDIATE SHAFT AND HOUSING EXPLODED DIAGRAM



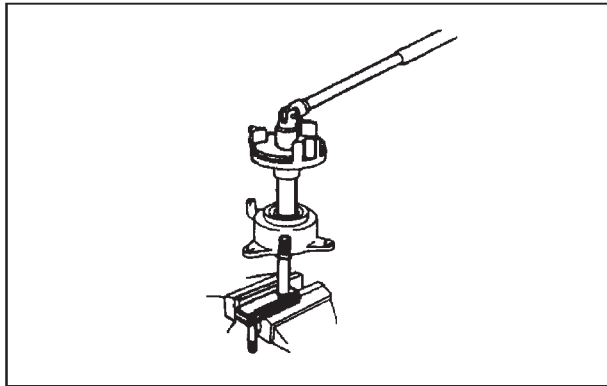


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Qty	Service Points
	<b>BEARING HOUSING UNIT REMOVAL</b>		Follow the "Step" order for removal.
	Engine Unit	1	Refer to "ENGINE UNIT REMOVAL."
1	Coupling Rubber	1	
2	Bolt (with washer)	3	
3	Bearing Housing Unit Assembly	1	
	<b>INTERMEDIATE HOUSING REMOVAL</b>		
	Cleanout tray		Refer to "JET PUMP CLEANOUT PORTS" in Chapter 6.
4	Hose Band	2	
5	Nut	3	
6	Washer	3	
7	Shim	1 set	Mark shim location for proper reinstallation. 8 x 55mm
8	Bolt (with washer)	3	
9	Intermediate Housing	1	
10	Locating Pin	2	
	<b>BEARING HOUSING UNIT DISASSEMBLY</b>		
①	Hose Tie	1	
②	Grease Hose	1	
③	Coupling	1	
④	Washer	1	
⑤	O-Ring	2	
⑥	Oil Seal	1	
⑦	Bearing	1	
⑧	Intermediate Shaft	1	
⑨	Oil Seal	1	
⑩	Circlip	2	
⑪	Ball Bearing	1	
			Reverse the removal steps for installation.



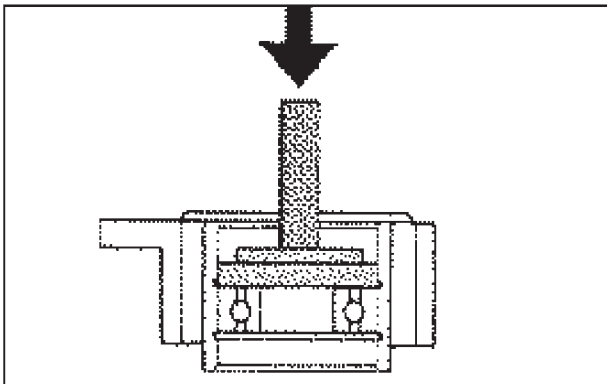
Distance ①: 0.06~0.08 in (1.6~2.0mm)  
 Distance ②: 0.37~0.41 in (9.5~10.5mm)  
 Distance ③: 0.27~0.28 in (6.8~7.2mm)  
 Distance ④: 0.69~0.70 in (17.6~17.7mm)



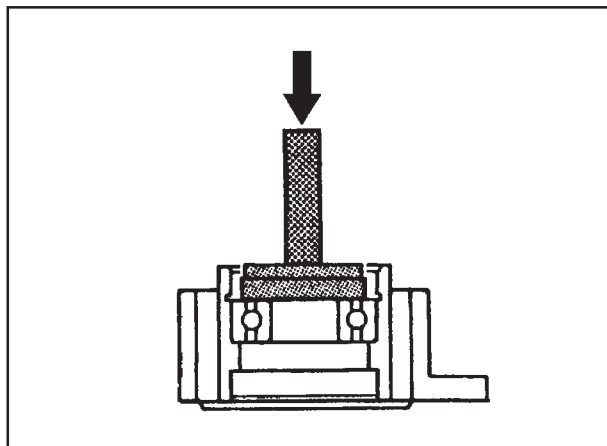
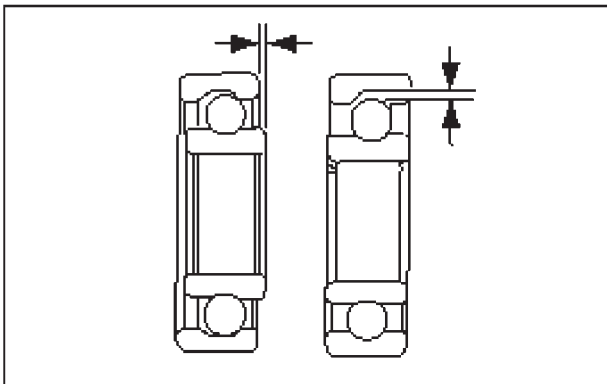
## SERVICE POINTS



**Coupler Wrench:**  
**YW-06546**  
**Shaft holder:**  
**YW-38742**



**Driver Rod:**  
**YB-06071**  
**Bearing Outer Race Attachment:**  
**YB-06015**



**Driver Rod:**  
**YB-06071**  
**Bearing Outer Race Attachment:**  
**YB-06156**



### Oil seal installation

#### 1. Install:

- Oil seal [T = 0.31 in (8mm)]



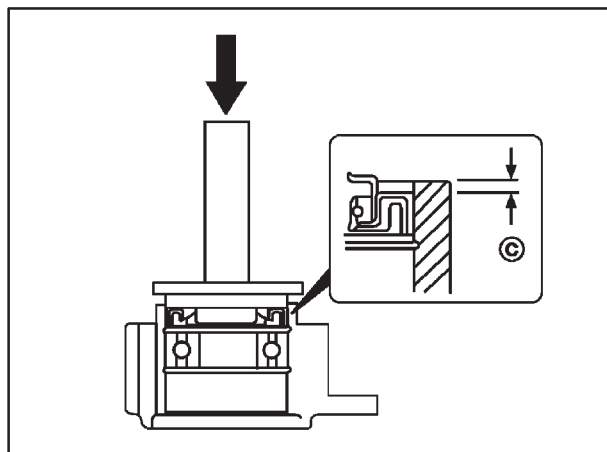
**Distance ①**  
0.27~0.28 in. (6.8~7.2mm)



**Driver Rod:**  
YB-06071  
**Bearing Outer Race Attachment:**  
YB-06156

#### NOTE:

Fill the water resistant grease on the clip inner circumference before installing the oil seal.

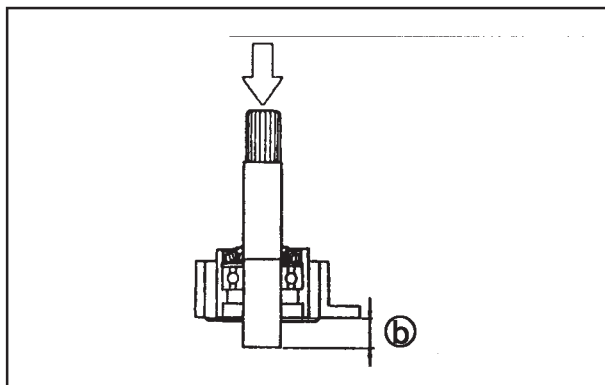


#### 2. Install:

- Shaft



**Distance ②**  
0.37~0.41 in. (9.5~10.5 mm)

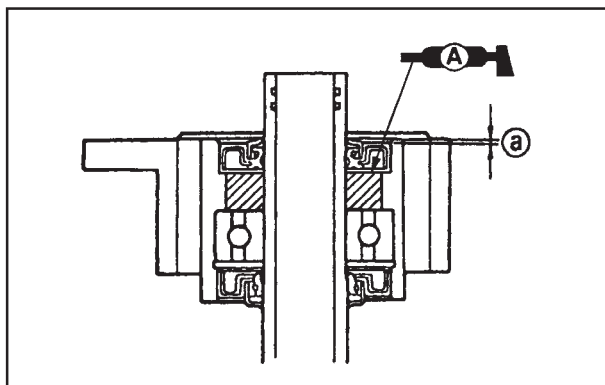


#### 3. Install:

- Oil Seal [T = 10mm (0.38 in)]



**Distance ③**  
0.06~0.08 in. (1.6~2.0 mm)



#### NOTE:

Fill the water resistant grease on the housing inner circumference before installing the oil seal.

---

## CHAPTER 7

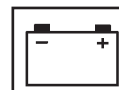
### ELECTRICAL SYSTEM

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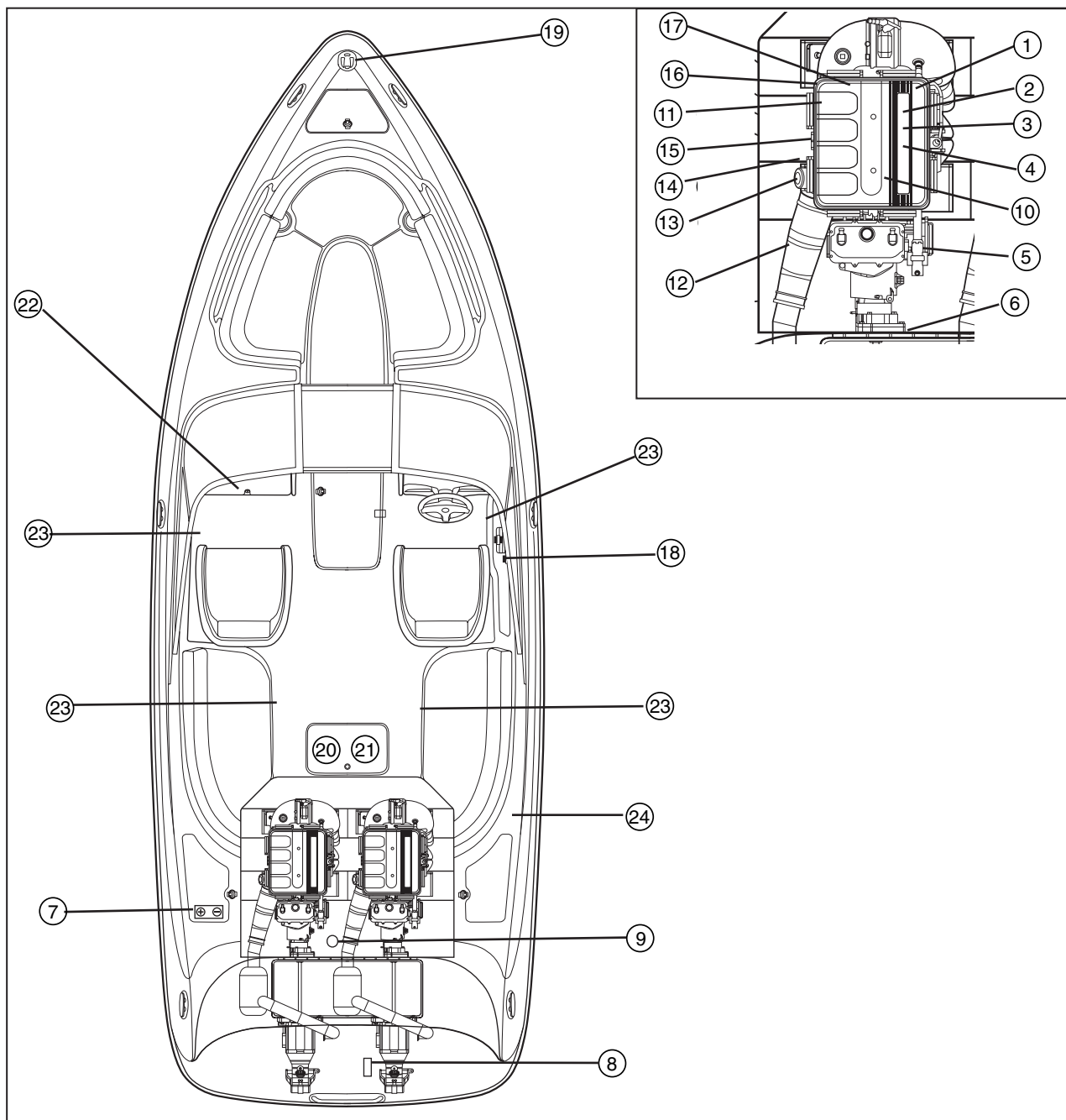


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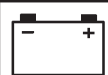
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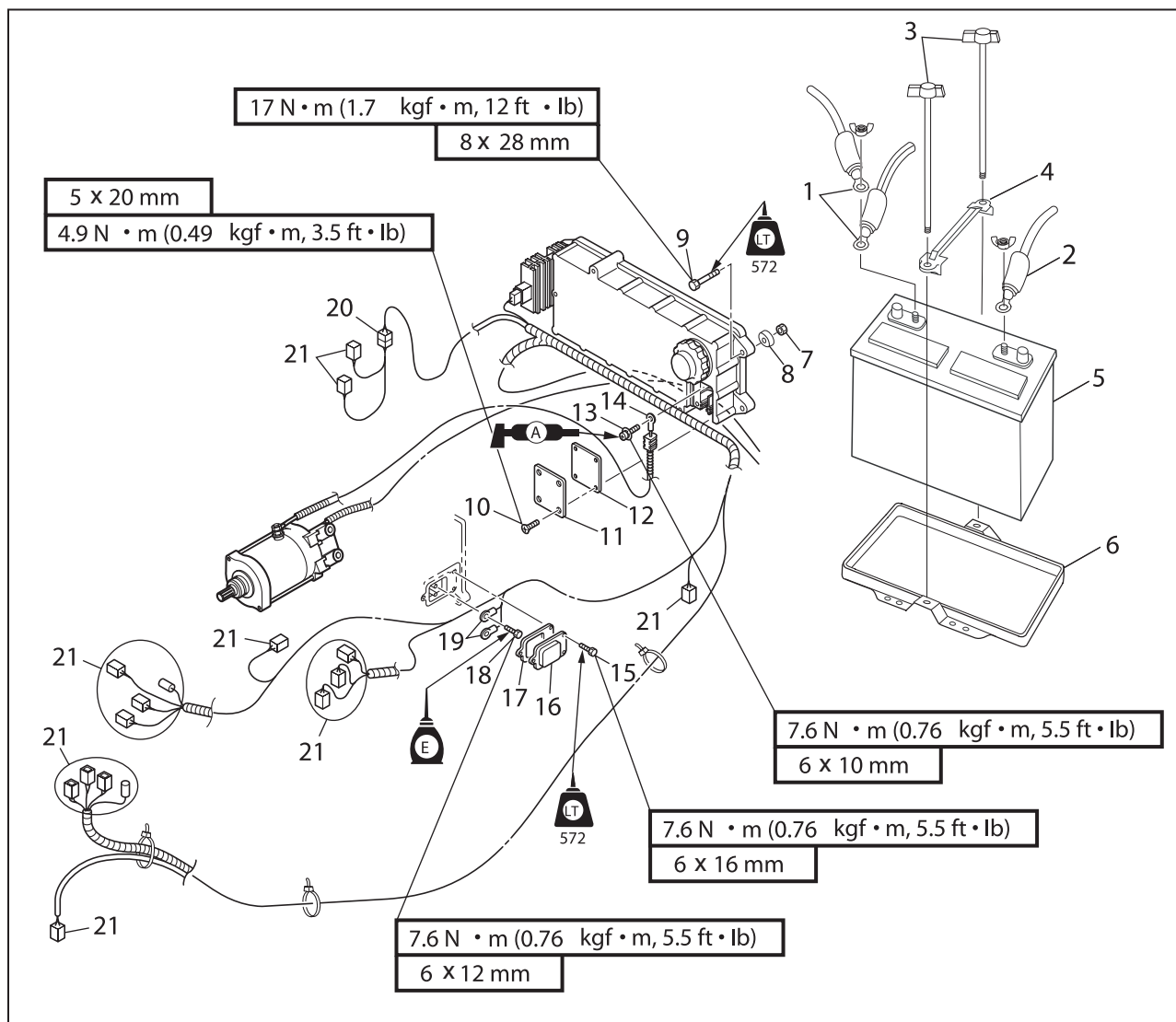
## ELECTRICAL COMPONENTS



- |                             |   |                 |
|-----------------------------|---|-----------------|
| ① Thermoswitch (engine)     | ⑩ Cam position sensor   | ⑲ Bow light     |
| ② Starter motor             | ⑪ Fuel injectors  | ⑳ Fuel pumps    |
| ③ Engine temperature sensor | ⑫ Thermoswitch (exhaust)                                      | ㉑ Fuel sender   |
| ④ Spark plugs               | ⑬ Oil pressure switch   | ㉒ Stereo        |
| ⑤ Ignition coils            | ⑭ Intake air pressure sensor                                  | ㉓ Speaker       |
| ⑥ Electrical box            | ⑮ Intake air temperature sensor                               | ㉔ Running Light |
| ⑦ Battery                   | ⑯ Throttle position sensor                                    |                 |
| ⑧ Speed sensor (AR model)   | ⑰ Lighting coil and pulser coil                               |                 |
| ⑨ Electric bilge pump       | ⑱ Engine stop switch, engine shut-off switch and start switch |                 |



## ELECTRICAL BOX AND IGNITION COIL BOX EXPLODED DIAGRAM

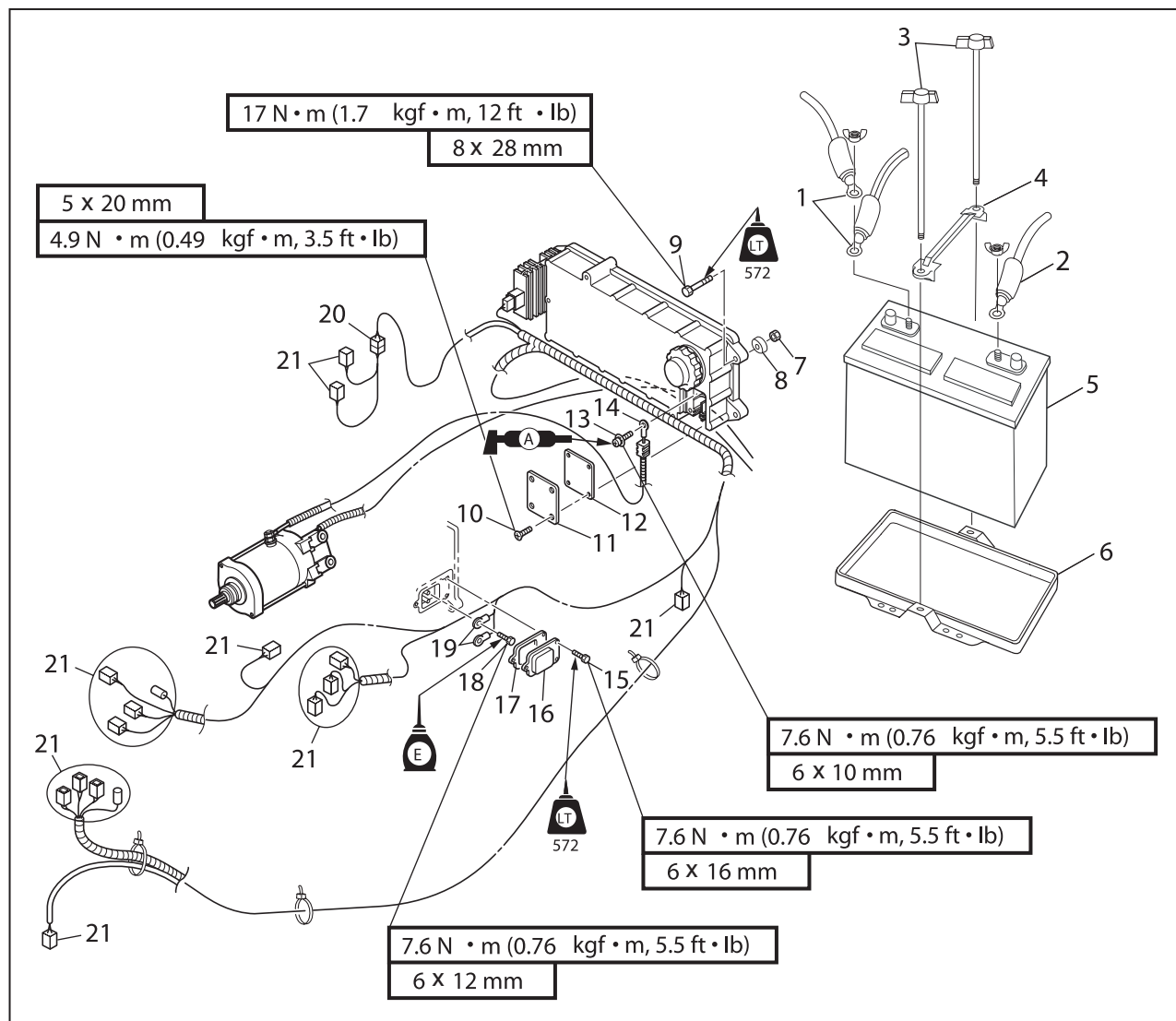


### REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Qty	Service Points
<b>ELECTRICAL BOX REMOVAL</b>			
1	Battery negative lead	1	Follow the left "Step" for removal.
2	Battery positive lead	1	
3	Bolt	2	
4	Battery hold down bracket	1	
5	Battery	1	
6	Battery tray	1	
7	Nut	4	
8	Washer	4	

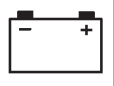


# **ELECTRICAL BOX AND IGNITION COIL BOX (Cont'd.)** **EXPLODED DIAGRAM**

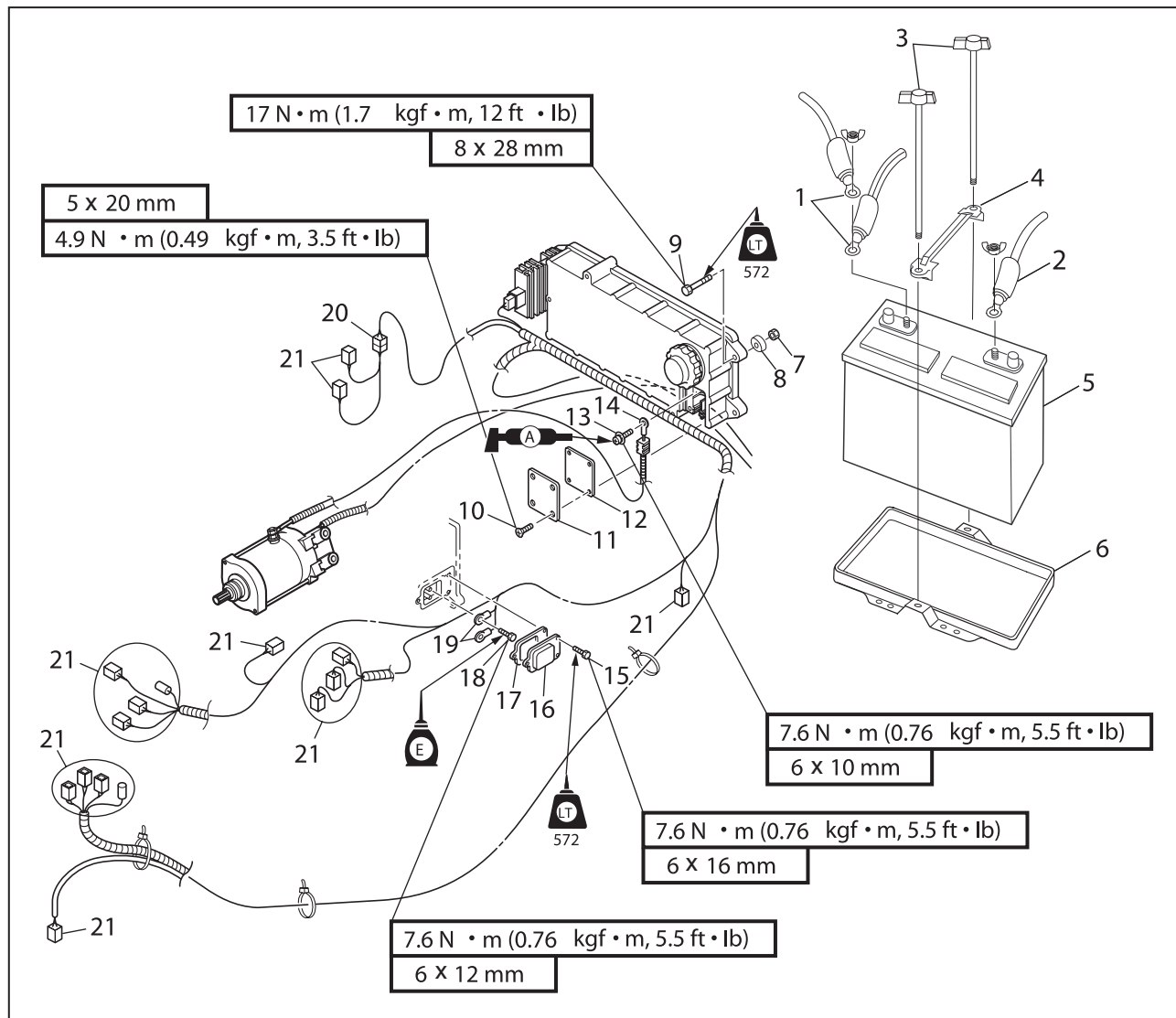


## **REMOVAL AND INSTALLATION CHART**

Step	Procedure / Part Name	Qty	Service Points
9	Bolt	4	<b>Not reusable</b>
10	Screw	4	
11	Terminal cover	1	
12	Gasket	1	
13	Screw	1	
14	Starter motor lead	1	
15	Bolt	3	
16	Cover	1	



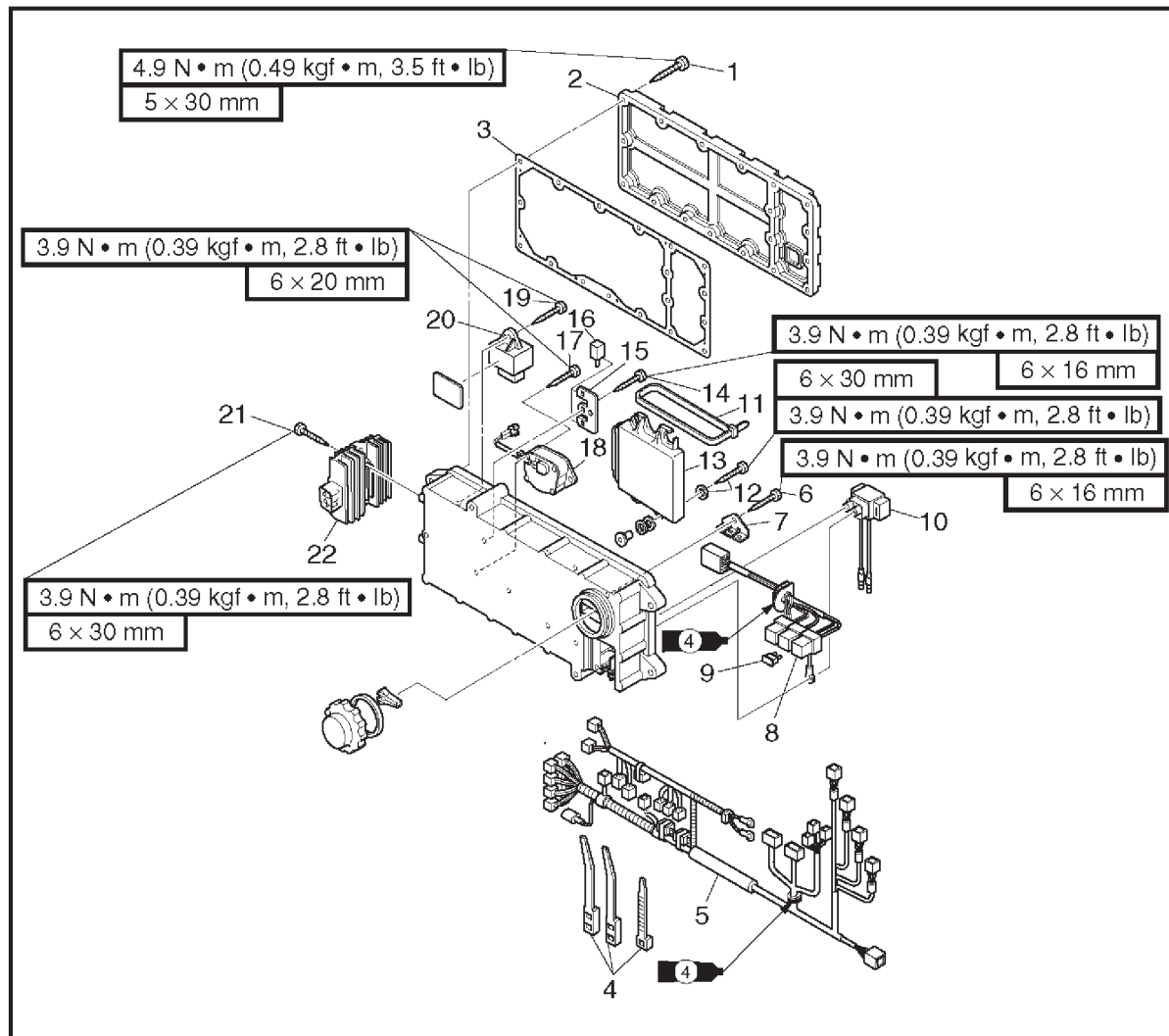
## ELECTRICAL BOX AND IGNITION COIL BOX (Cont'd.) EXPLODED DIAGRAM



## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
17	Gasket	1	<b>Not reusable</b>  <b>NOTE:</b> Disconnect all couplers.  Reverse the removal steps for installation.
18	Bolt	2	
19	Ground led	2	
20	Holder	1	
21	Coupler	15	

## ELECTRICAL BOX (Cont'd.) EXPLODED DIAGRAM

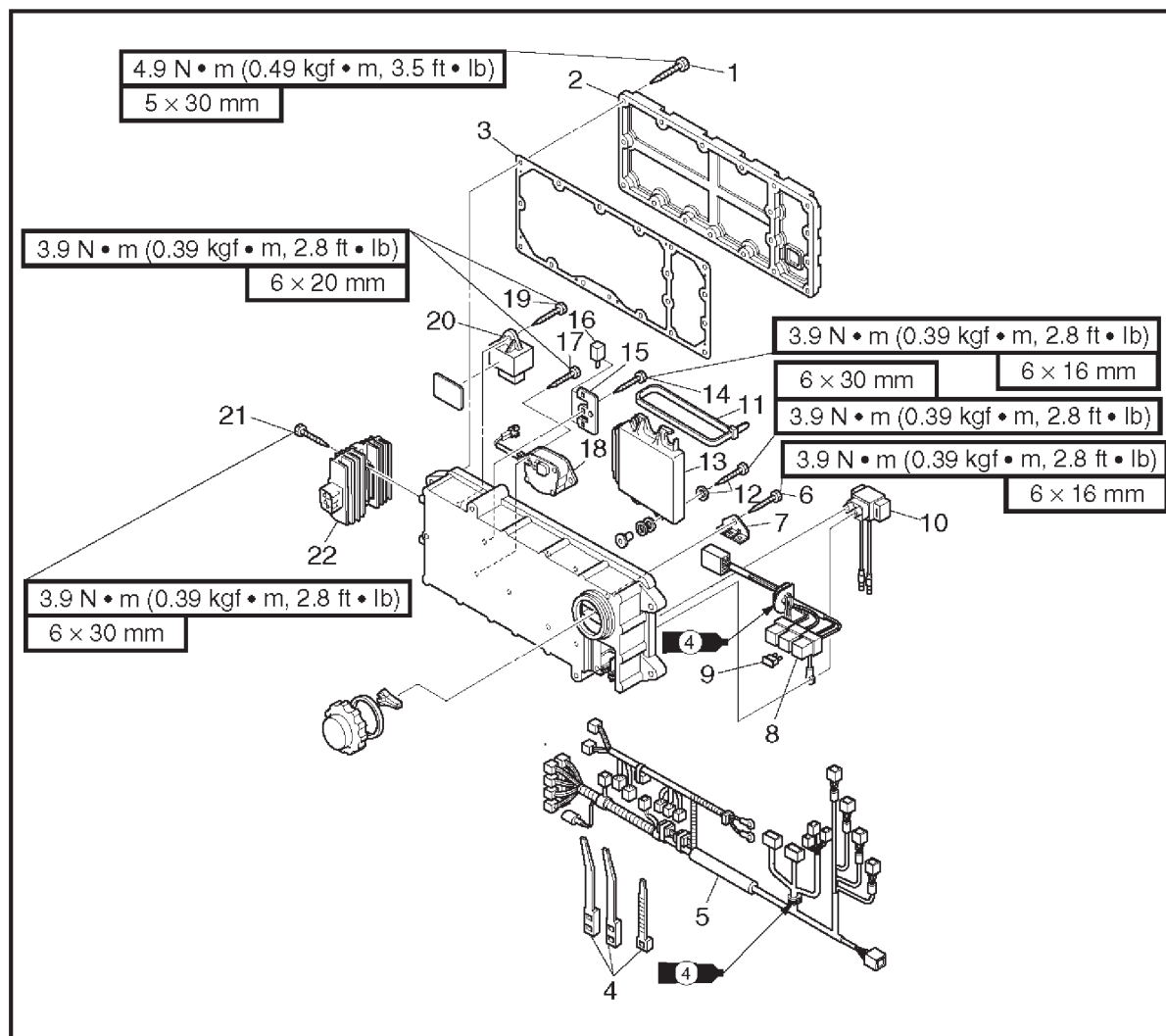


## REMOVAL AND INSTALLATION CHART

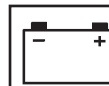
Step	Procedure/Part name	Q'ty	Service points
	<b>ELECTRICAL BOX DISASSEMBLY</b>		Follow the left "Step" for disassembly.
1	Tapping screw	18	
2	Cover	1	
3	Gasket	1	
4	Clamp	3	
5	Wiring harness	1	
6	Tapping screw	1	
7	Fuse holder stay	1	
8	Wiring harness	1	
9	Fuse	6	



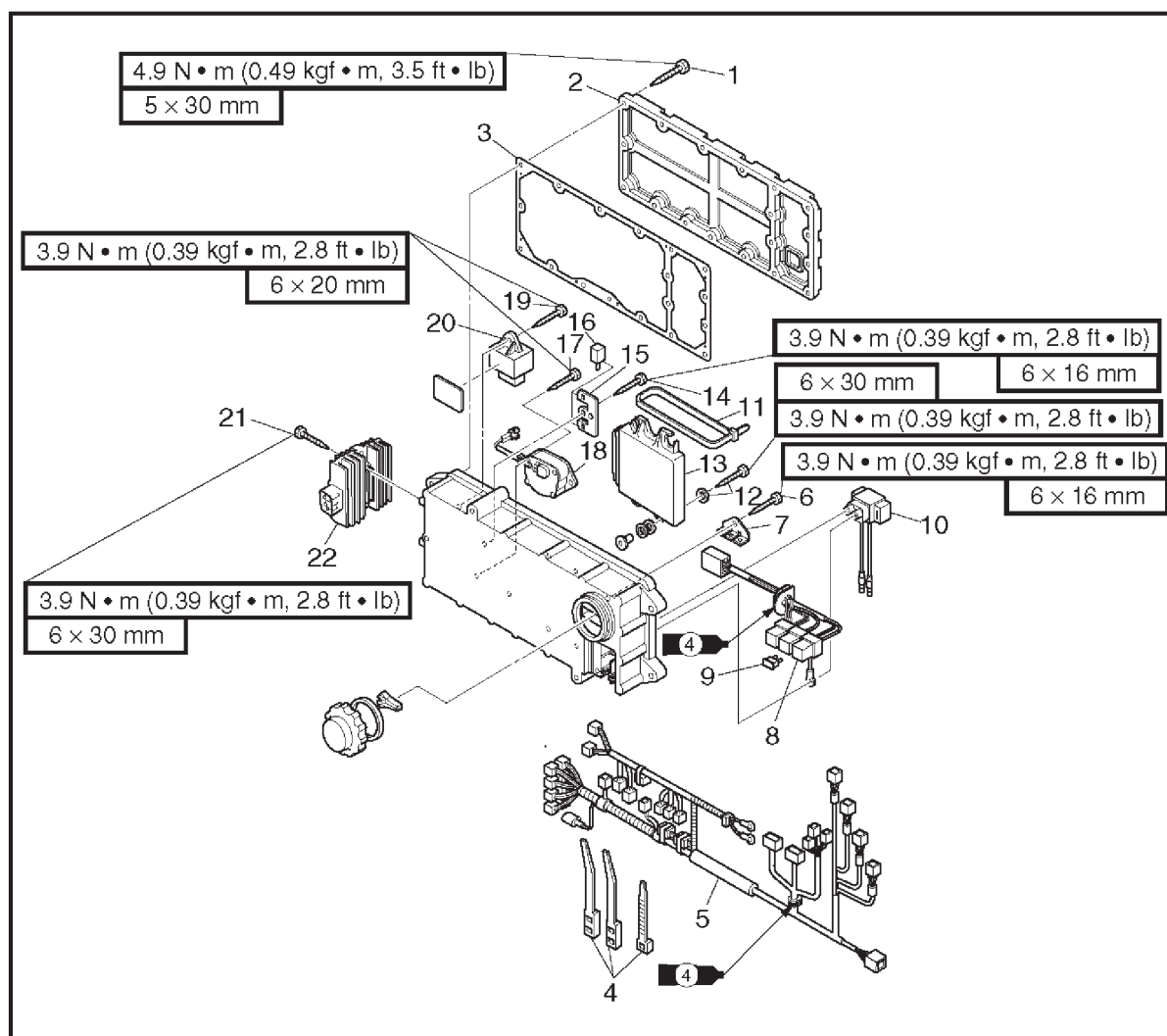
## ELECTRICAL BOX (Cont'd.) EXPLODED DIAGRAM



Step	Procedure/Part name	Q'ty	Service points
10	Starter relay	1	
11	Clamp	2	
12	Tapping screw/washer	4/4	
13	ECM	1	
14	Tapping screw	1	
15	Bracket	1	
16	Joint connector	2	
17	Tapping screw	2	
18	Slant detection switch	1	
19	Tapping screw	1	
20	Main and fuel pump relay	1	



# **ELECTRICAL BOX (Cont'd.)** **EXPLODED DIAGRAM**

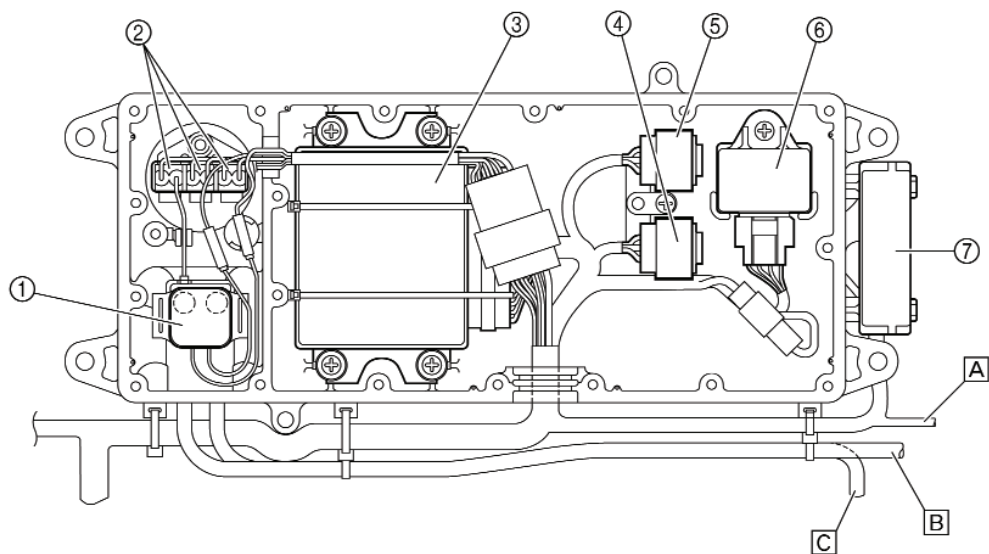


Step	Procedure/Part name	Q'ty	Service points
21	Tapping screw	2	Reverse the disassembly steps for assembly.
22	Rectifier/regulator	1	



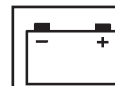


**ELECTRICAL BOX (Cont'd.)**  
**EXPLODED DIAGRAM**



- ① Starter relay
- ② Fuse holder
- ③ ECM
- ④ Joint connector
- ⑤ Joint connector
- ⑥ Main and fuel pump relay
- ⑦ Rectifier/regulator

- A To ignition coil
- B To battery positive terminal
- C To starter motor

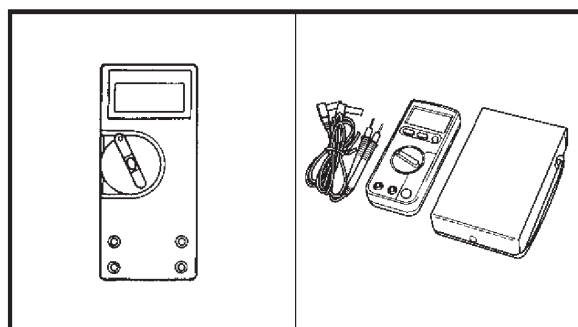


## ELECTRICAL BOX (Cont'd.) EXPLODED DIAGRAM

### ELECTRICAL ANALYSIS INSPECTION

#### CAUTION:

- All measuring instruments should be handled with special care. Damaged or mis-handled instruments will not measure properly.
- On an instrument powered by dry batteries, check the battery's voltage periodically and replace the batteries if necessary.



#### Digital tester

#### NOTE:

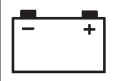
Throughout this chapter the part numbers of the specified digital testers have been omitted. Refer to the following part numbers.



**Digital multimeter:**  
YU-34899-A  
**Digital circuit tester:**  
90890-03174

#### NOTE:

“○—○” indicates a continuity of electricity; i.e., a closed circuit at the respective switch position.



## ELECTRICAL ANALYSIS

## Low resistance measurement

## NOTE:

- When measuring a resistance of  $10\Omega$  or less, the correct measurement value may not be displayed due to the meter's internal resistance.
- Obtain the correct value by subtracting the internal resistance of the meter from the displayed measurement.
- Obtain the meter's internal resistance by connecting the meter's leads directly together and reading the display.

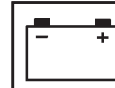


Correct value =  
Displayed measurement –  
Internal resistance

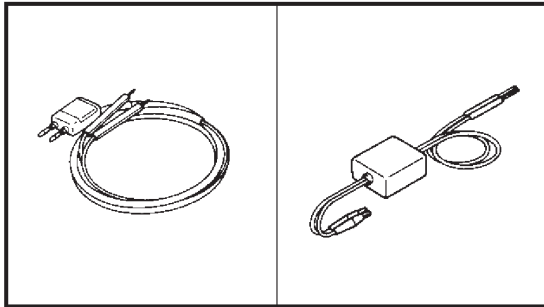
## Peak voltage measurement

## NOTE:

- When checking the condition of the ignition system it is vital to know the peak voltage.
  - Cranking speed is dependant on many factors (e.g., fouled or weak spark plugs, a weak battery). If one of these is defective, the peak voltage will be lower than specification.
  - If the peak voltage measurement is not within specification the engine will not operate properly.
  - A low peak voltage will also cause components to prematurely wear.
-



## ELECTRICAL ANALYSIS (Cont'd.)



## Peak voltage adapter

## NOTE:

- Throughout this chapter the peak voltage adapter's part number has been omitted. Refer to the following part number.
- The peak voltage adapter should be used with the digital tester.

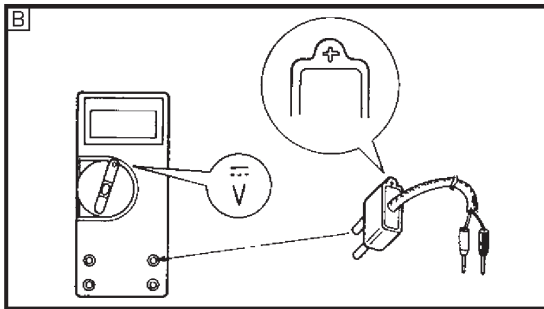
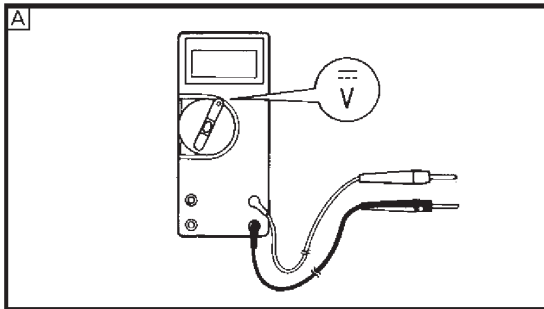


## Peak volt meter adapter:

YU-39991

## Peak voltage adapter B:

90890-03172

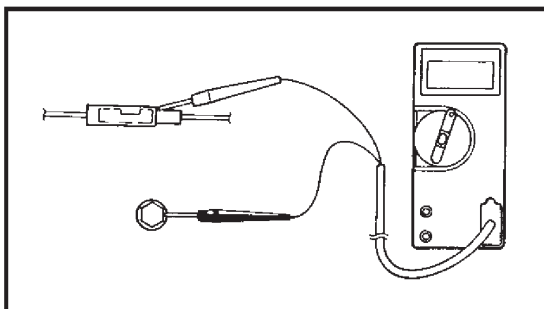


## NOTE:

- When measuring the peak voltage, connect the peak voltage adapter to the digital circuit tester and switch the selector to the DC voltage mode.
- Make sure that the adapter leads are properly installed in the digital circuit tester.
- Make sure that the positive pin (the "+" mark facing up as shown) on the adaptor is installed into the positive terminal of the tester.
- The test harness is needed for the following tests.

A Voltage measurement

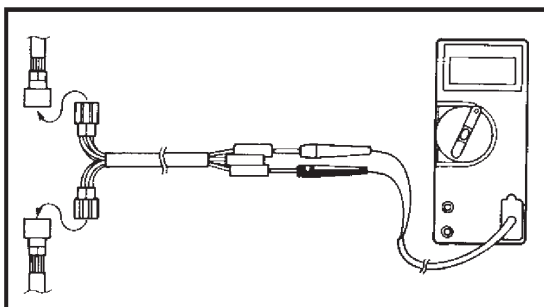
B Peak voltage measurement



## Test harness

## Checking steps:

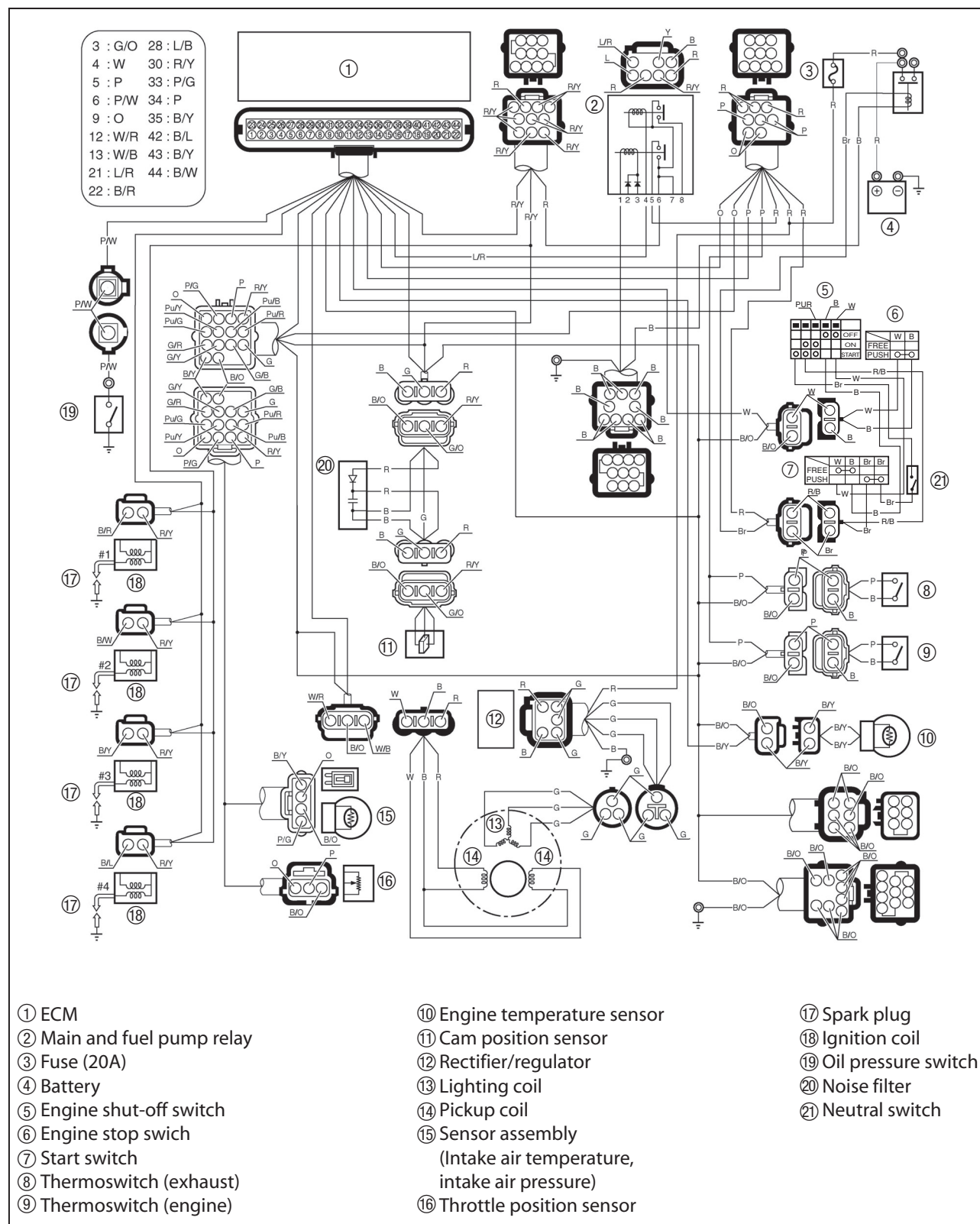
- Disconnect the coupler connections.
- Connect the test harness between the couplers.
- Connect the tester terminals to the terminals which are being checked.
- Run the engine and observe the measurement.



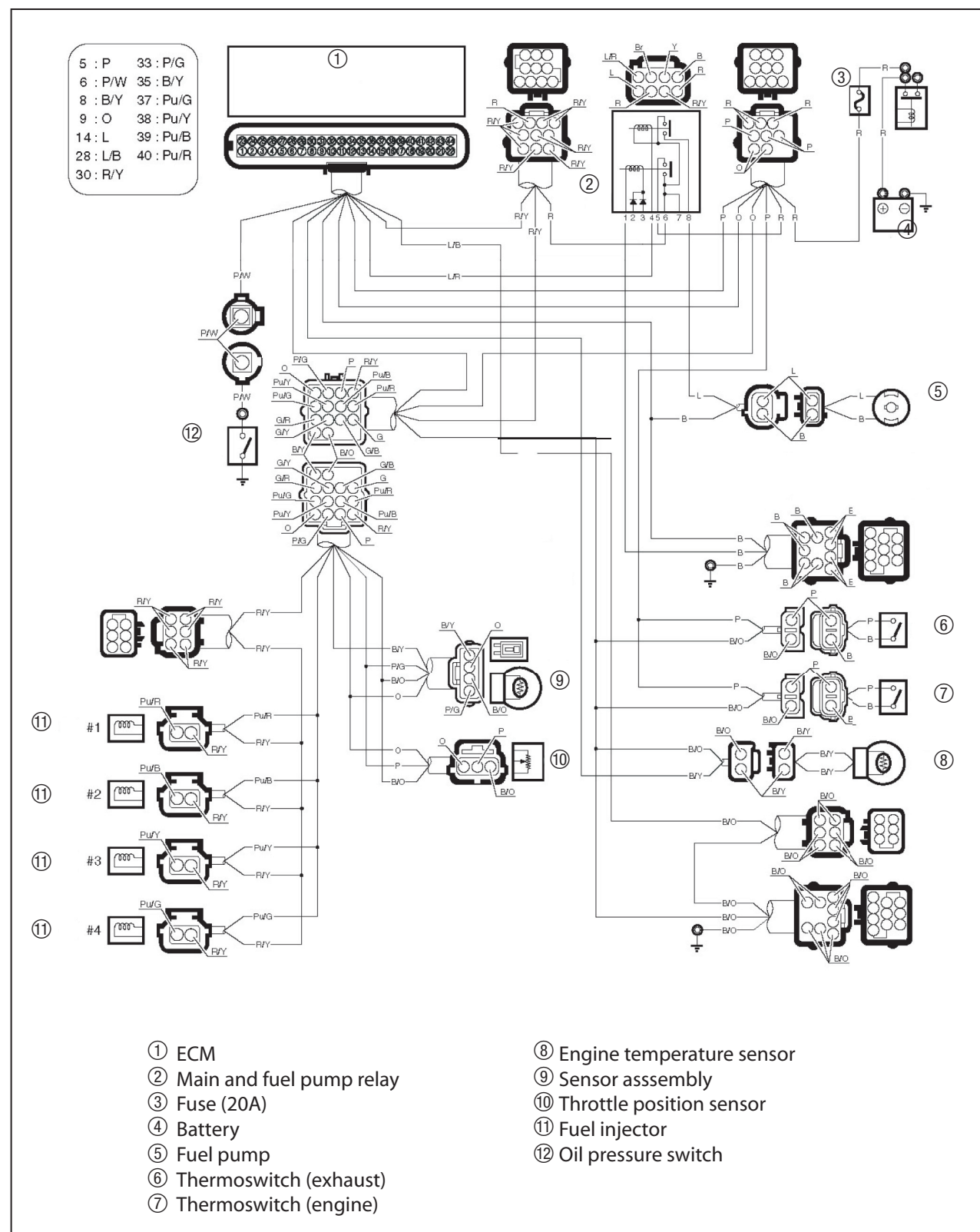
## NOTE:

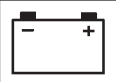
If the lighting coil and pickup coil(s) are measured unloaded, disconnect the test harness on the output side coupler.

## IGNITION SYSTEM WIRING DIAGRAM

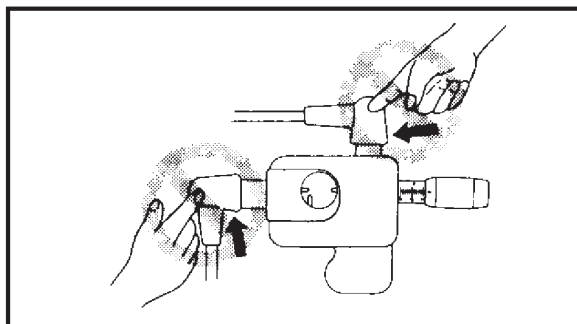


# IGNITION SYSTEM (Cont'd.) WIRING DIAGRAM





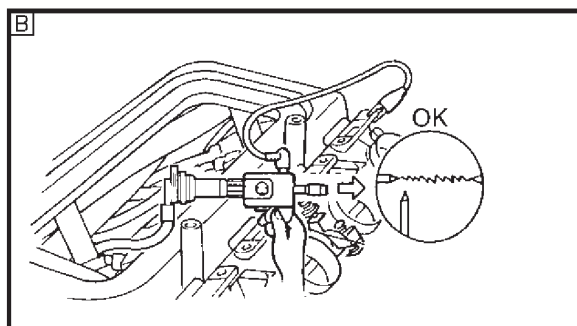
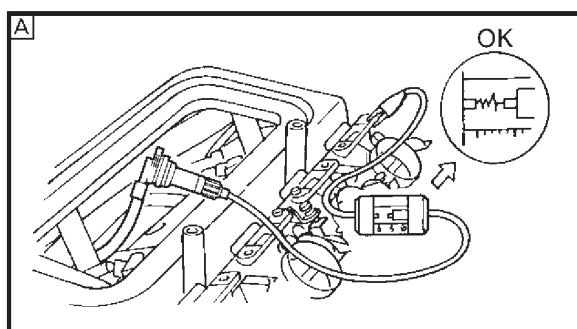
## IGNITION SYSTEM (Cont'd.)



## IGNITION SPARK

**⚠ WARNING**

- When checking the spark gap, do not touch any of the connections of the spark gap tester lead wires.
- When performing the spark gap test, take special care not to let sparks leak out of the removed spark plug cap.
- When performing the spark gap check, keep flammable gas or liquids away, since this test can produce sparks.



## 1. Check:

- Ignition spark  
Weak → Check the ECM output peak voltage.  
Check the ignition coil for resistance.

**Checking steps:**

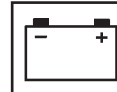
- Connect the spark plug cap to the spark gap tester.

**Spark gap tester:****YM-34487****Ignition tester:****90890-06754**

- Crank the engine and observe the ignition system spark through the discharge window.

A For USA and Canada

B For worldwide



## IGNITION SYSTEM (Cont'd.)

## IGNITION SYSTEM PEAK VOLTAGE

**⚠ WARNING**

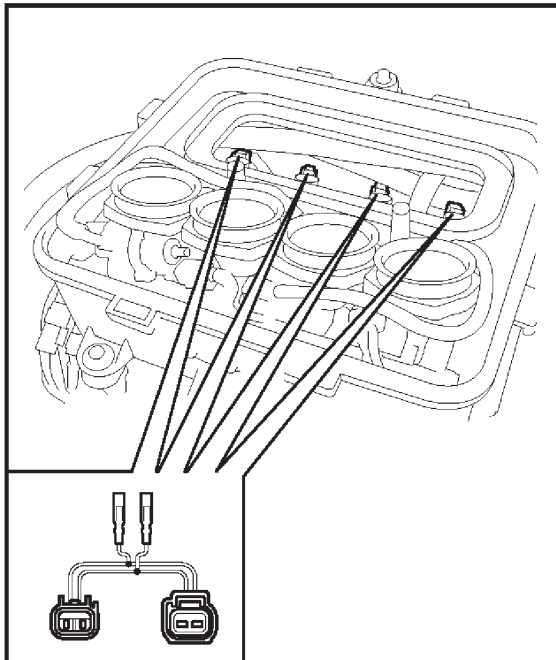
When checking the electrical components, do not touch any of the connections of the digital tester lead wires.

**NOTE:**

- If there is no spark, or the spark is weak, continue with the ignition system test.
- If a good spark is obtained, the problem is not with the ignition system, but possibly with the spark plug(s) or another component.

## 1. Measure:

- ECM output peak voltage  
Below specification → Measure the pickup coil output peak voltage.

**Test harness (2 pins):**

New: YB-06867

Current: YB-06767

**Test harness FWY-2 (2 pins):**

New: 90890-06867

Current: 90890-06767

**ECM output peak voltage:**

Black/red (B/R) –

Red/yellow (R/Y)

Black/white (B/W) –

Red/yellow (R/Y)

Black/yellow (B/Y) –

Red/yellow (R/Y)

Black/blue (B/L) –

Red/yellow (R/Y)

r/min	Loaded		
	Cranking	2,000	3,500
V	87	86	85

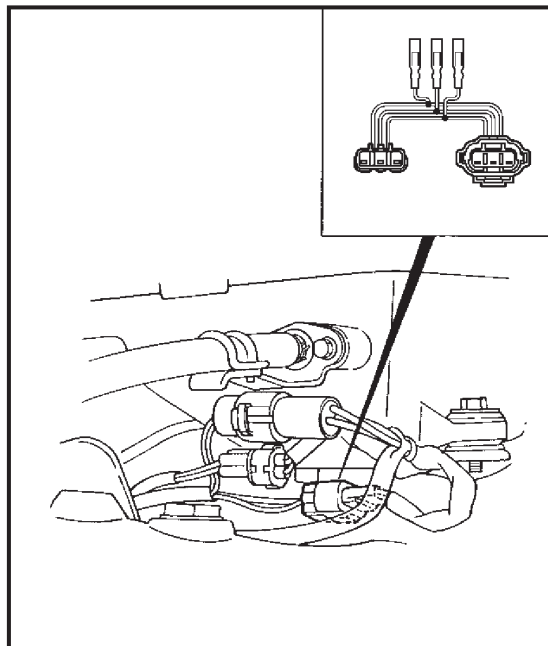
**NOTE:**

- When measuring the ECM output peak voltage while cranking the engine, disconnect the ignition coil couplers for all cylinders except for the cylinder being measured.
- To crank the engine, connect the engine shut-off cord (lanyard) to the engine shut-off switch, and then press the start switch.





## IGNITION SYSTEM (Cont'd.)



## 2. Measure:

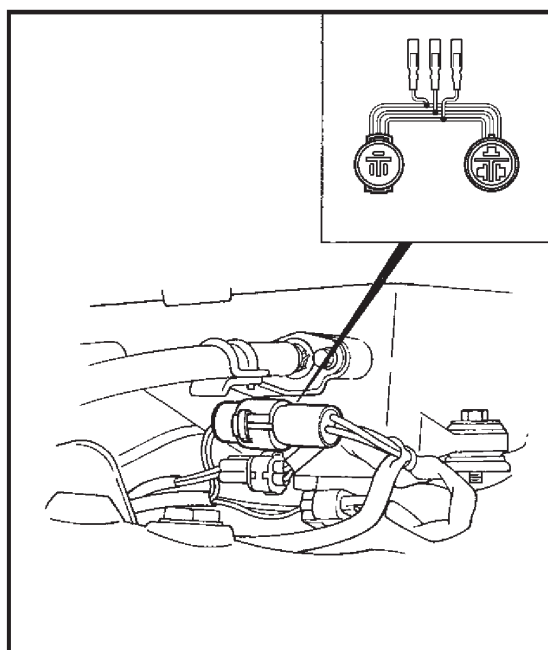
- Pickup coil output peak voltage  
Below specification → Replace the pickup coil.  
Above specification → Replace the ECM.

**Test harness (3 pins):****New:** YB-06877**Current:** YB-06777**Test harness HM090-3 (3 pins):****New:** 90890-06877**Current:** 90890-06777**Pickup coil output peak voltage:****White (W) – Black (B)****Red (R) – Black (B)**

r/min	Unloaded	Loaded		
	Cranking		2,000	3,500
V	5.2	4.7	26.1	41.3

**NOTE:**

To crank the engine, connect the engine shut-off cord (lanyard) to the engine shut-off switch, and then press the start switch and engine stop switch simultaneously.

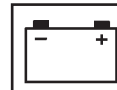


## 3. Measure:

- Lighting coil output peak voltage  
Below specification → Replace the lighting coil.

**Test harness (3 pins):****New:** YB-06870**Current:** YB-06770**Test harness SMT250-3 (3 pins):****New:** 90890-06870**Current:** 90890-06770**Lighting coil output peak voltage:****Green (G) – Green (G)**

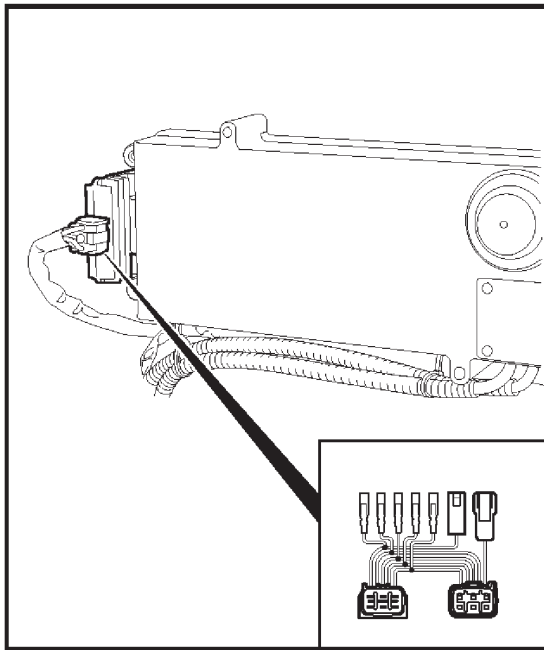
r/min	Unloaded		
	Cranking	2,000	3,500
V	9.2	38.5	63.2



## IGNITION SYSTEM (Cont'd.)

**NOTE:**

To crank the engine, connect the engine shut-off cord (lanyard) to the engine shut-off switch, and then press the start switch and engine stop switch simultaneously.



## 4. Measure:

- Rectifier/regulator output voltage  
Below specification → Replace the rectifier/regulator.



**Test harness (6 pins):**

**YB-06848**

**Test harness FSW-6A (6 pins):**

**90890-06848**



**Rectifier/regulator output voltage:**

**Red (R) – Black (B)**

r/min	Unloaded
	3,500
V	15.0

**NOTE:**

- Do not use the peak voltage adapter to measure the output voltage.
- Disconnect the output lead of the tester harness.

**BATTERY**

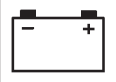
Refer to "ELECTRICAL" in Chapter 3.

**FUSE**

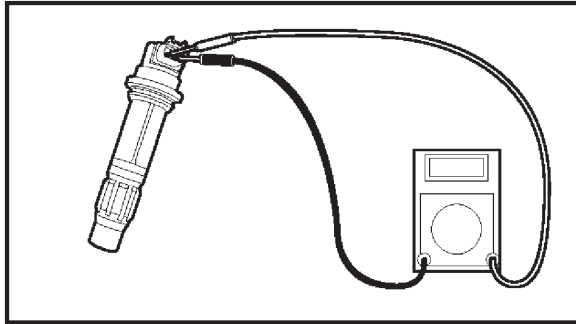
Refer to "STARTING SYSTEM".

**SPARK PLUGS**

Refer to "POWER UNIT" in Chapter 3.



## IGNITION SYSTEM (Cont'd.)



## IGNITION COIL

## 1. Measure:

- Primary coil resistance
- Out of specification → Replace.

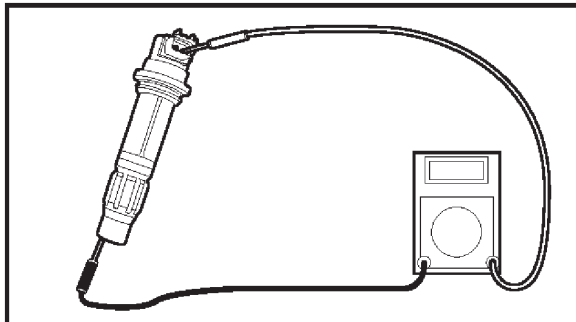


**Primary coil resistance:**  
1.19–1.61  $\Omega$  at 20 °C (68 °F)

**NOTE:**

When measuring a resistance of 10  $\Omega$  or less with the digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.

Refer to "Low resistance measurement".

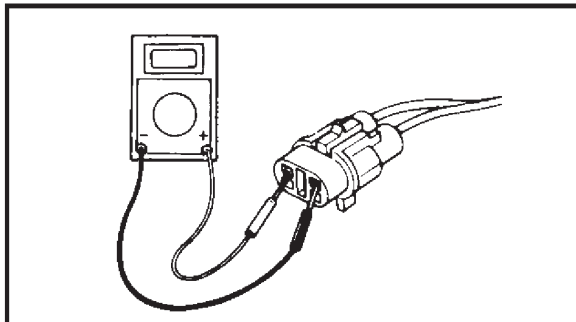


## 2. Measure:

- Secondary coil resistance
- Out of specification → Replace.



**Secondary coil resistance:**  
8.5–11.5 k $\Omega$  at 20 °C (68 °F)



## ENGINE STOP SWITCH

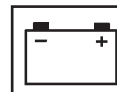
## 1. Check:

- Engine stop switch continuity
- Out of specification → Replace.

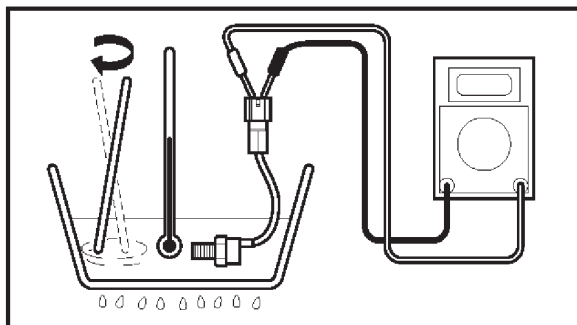


**Engine stop switch continuity**  
(black coupler)

Lanyard Clip	White	Black
Installed	O	O
Removed	O—	—O



## IGNITION SYSTEM (Cont'd.)



## ENGINE TEMPERATURE SENSOR

## 1. Measure:

- Engine temperature sensor resistance (at the specified temperature)

Out of specification → Replace.

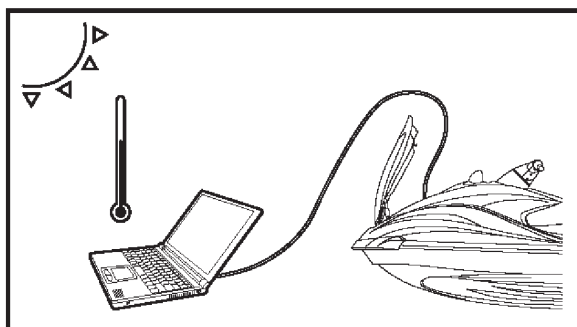
**Engine temperature sensor resistance:**

20 °C (68 °F): 54.2–69.0 k $\Omega$

100 °C (212 °F): 3.12–3.48 k $\Omega$

**Measurement steps:**

- Suspend the engine temperature sensor in a container filled with water.
- Slowly heat the water.
- Measure the resistance when the specified temperature is reached.

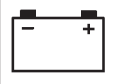
INTAKE AIR  
SENSOR ASSEMBLY

## 1. Check:

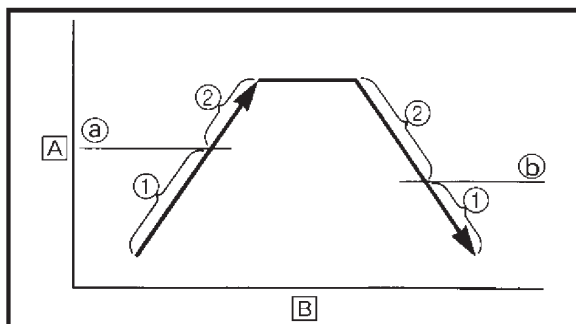
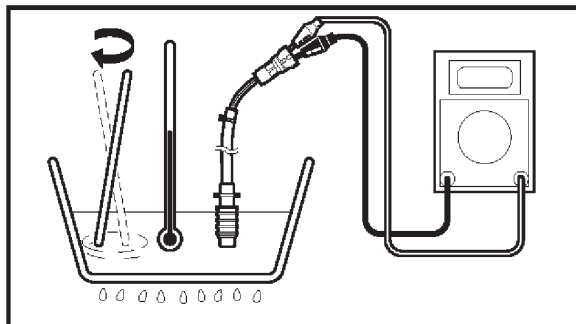
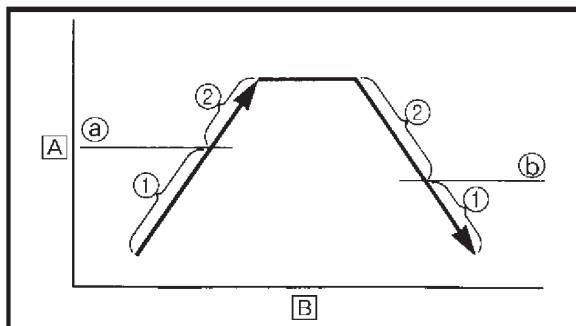
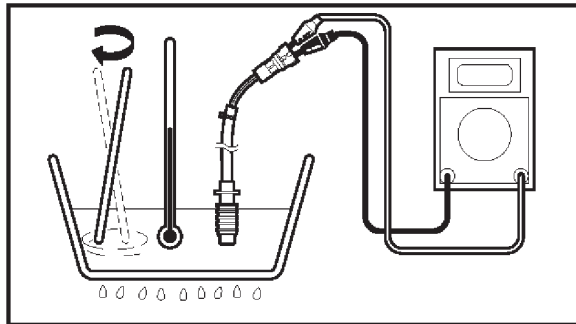
- Intake air temperature sensor
- Out of specification → Replace the sensor assembly.

**Checking steps:**

- Measure the ambient temperature.
- Connect a computer to the watercraft and use the Yamaha Diagnostic System to display the intake air temperature.
- If the ambient temperature and the displayed intake air temperature differ by more than  $\pm 5$  °C ( $\pm 9$  °F), replace the sensor assembly.



## IGNITION SYSTEM (Cont'd.)



## THERMOSWITCH (ENGINE)

## 1. Check:

- Thermoswitch (engine) continuity (at the specified temperature)  
Out of specification → Replace.

**Thermoswitch (engine) continuity temperature:**

- Ⓐ 84–90 °C (183–194 °F)
- Ⓑ 70–84 °C (158–183 °F)

- ① No continuity
- ② Continuity

- Ⓐ Temperature
- Ⓑ Time

**Checking steps:**

- Suspend the thermoswitch (engine) in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the continuity when the specified temperature is reached.

## THERMOSWITCH (EXHAUST)

## 1. Check:

- Thermoswitch (exhaust) continuity (at the specified temperature)  
Out of specification → Replace.

**Thermoswitch (exhaust) continuity temperature:**

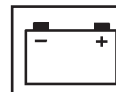
- Ⓐ 94–100 °C (201–212 °F)
- Ⓑ 80–94 °C (176–201 °F)

- ① No continuity
- ② Continuity

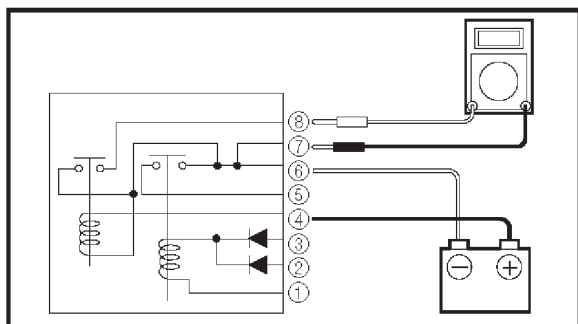
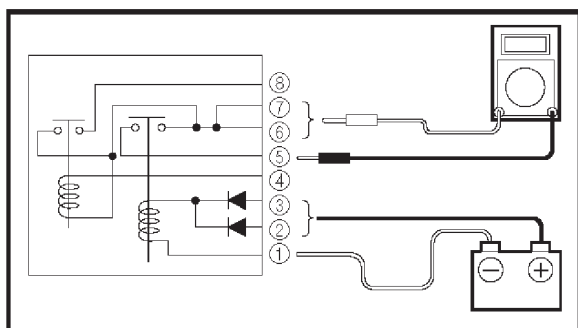
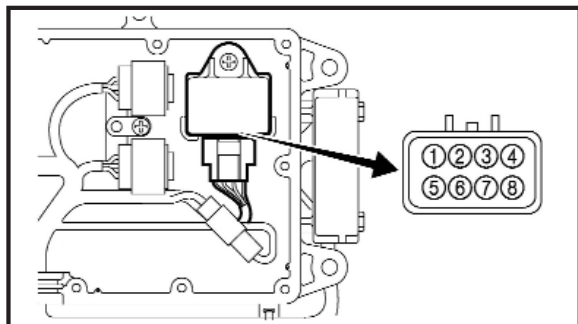
- Ⓐ Temperature
- Ⓑ Time

**Checking steps:**

- Suspend the thermoswitch (exhaust) in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the continuity when the specified temperature is reached.



## IGNITION SYSTEM (Cont'd.)



## MAIN AND FUEL PUMP RELAY

## 1. Check:

- Main and fuel pump relay continuity
- Faulty → Replace.

**Checking steps:**

- Connect the tester leads between the main and fuel pump relay terminals ⑤, ⑥ and ⑦.
- Connect the terminals ② or ③ to the positive battery terminal.
- Connect the terminal ① to the negative battery terminal.
- Check that there is continuity between the main and fuel pump relay terminals.
- Check that there is no continuity between the main and fuel pump relay terminals after disconnecting terminals ②, ③ or ①.
- Connect the tester leads between the main and fuel pump relay terminals ⑦ and ⑧.
- Connect the terminals ④ to the negative battery terminal.
- Connect the terminal ⑥ to the positive battery terminal.
- Check that there is continuity between the main and fuel pump relay terminals.
- Check that there is no continuity between the main and fuel pump relay terminals after disconnecting terminals ④ or ⑥.

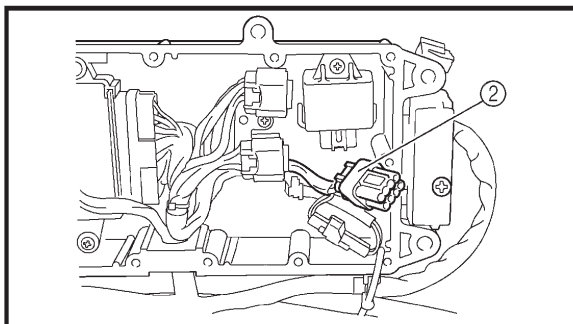
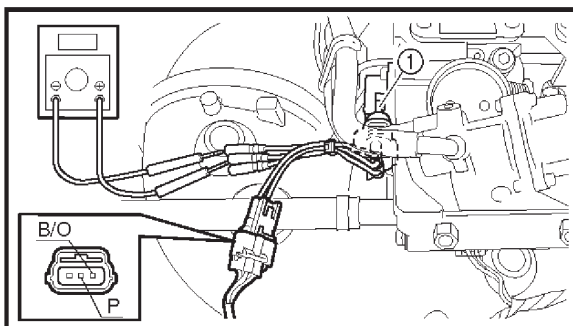


## IGNITION SYSTEM (Cont'd.)

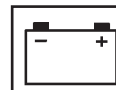
## THROTTLE POSITION SENSOR

## 1. Measure:

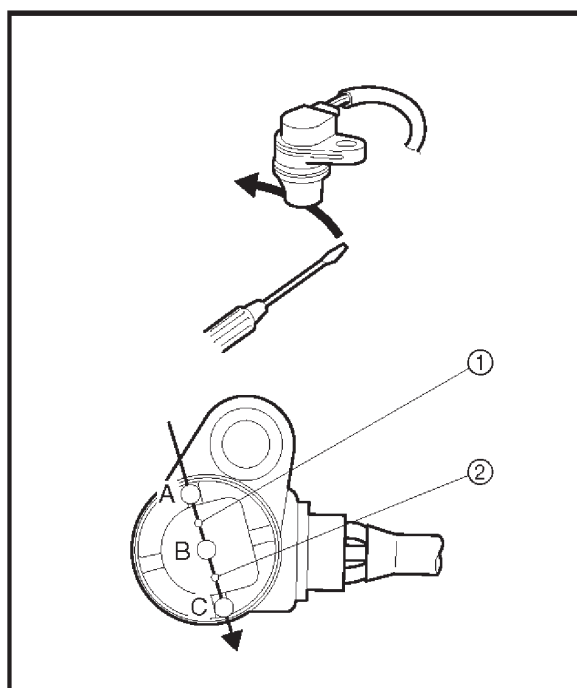
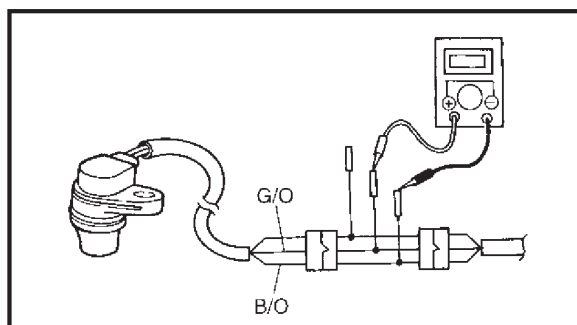
- Throttle position sensor output voltage  
Out of specification → Adjust the throttle bodies synchronization.  
Refer to “FUEL INJECTION SYSTEM” in Chapter 4.

**Test harness (3 pins):****YB-06793****Test harness SMHW099-3****(3 pins):****90890-06793****Test connector:****YW-06862****Test connector FMY-8:****90890-06862****Throttle position sensor output voltage:****Pink (P) – Black/orange (B/O)** **$0.756 \pm 0.016$  V****Measurement steps:**

- Connect the test harness (3 pins) to the throttle position sensor ①.
- To start the ECM normally, use the Yamaha Diagnostic System. Use the test connector ② to start the ECM normally only if the Yamaha Diagnostic System is not available.
- Measure the throttle position sensor output voltage.



## IGNITION SYSTEM (Cont'd.)



## CAM POSITION SENSOR

## 1. Measure:

- Cam position sensor output voltage  
Out of specification → Replace.



## Test harness (3 pins):

New: YB-06877

Current: YB-06777

## Test harness HM090-3 (3 pins):

New: 90890-06877

Current: 90890-06777



## Cam position sensor output voltage:

Green/orange (G/O) –  
Black/orange (B/O)

Position	Voltage (V)
A	More than 4.8
B	Less than 0.8
C	More than 4.8

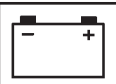
## Measurement steps:

- Remove the cam position sensor.
- Connect the test harness (3 pins) to the cam position sensor.
- Operate the Yamaha Diagnostic System.
- Measure the output voltage when a screwdriver is passed under the cam position sensor in the direction shown.

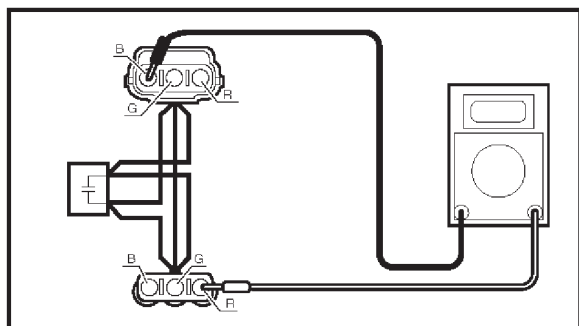
## NOTE:

- The cam position sensor contains two individual sensors as shown in the illustration: sensor 1 ① and sensor 2 ②.
- To measure the output voltage, pass the screwdriver under the measuring positions A, B (center), and C of the cam position sensor in order.
- When operating the Yamaha Diagnostic System, electric power is supplied to the cam position sensor.





## IGNITION SYSTEM (Cont'd.)

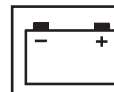


## NOISE FILTER

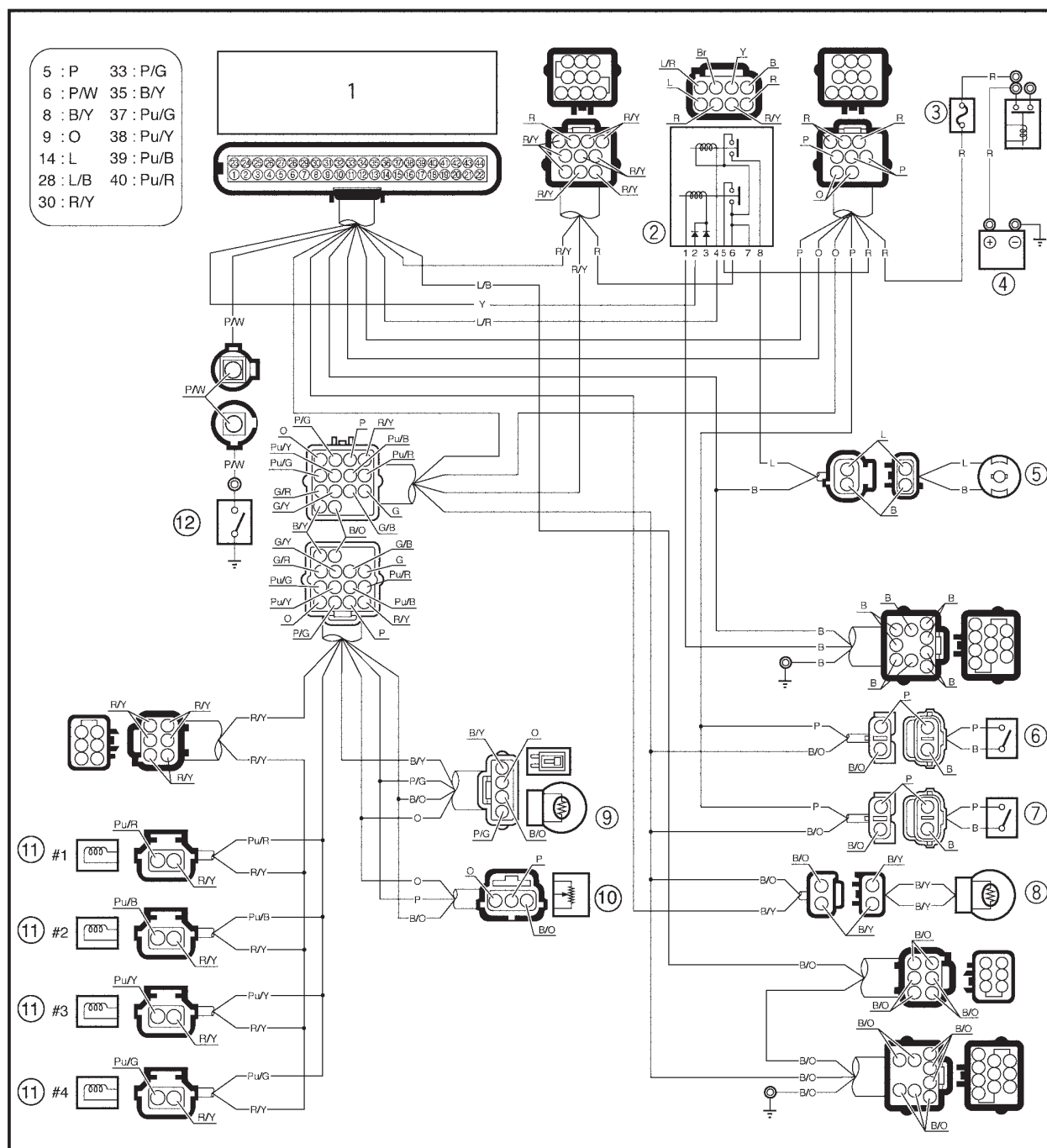
## 1. Check:

- Noise filter continuity  
Out of specification → Replace.

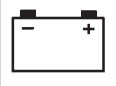
	Noise filter continuity:	
	Black (B) – Red (R)	No continuity



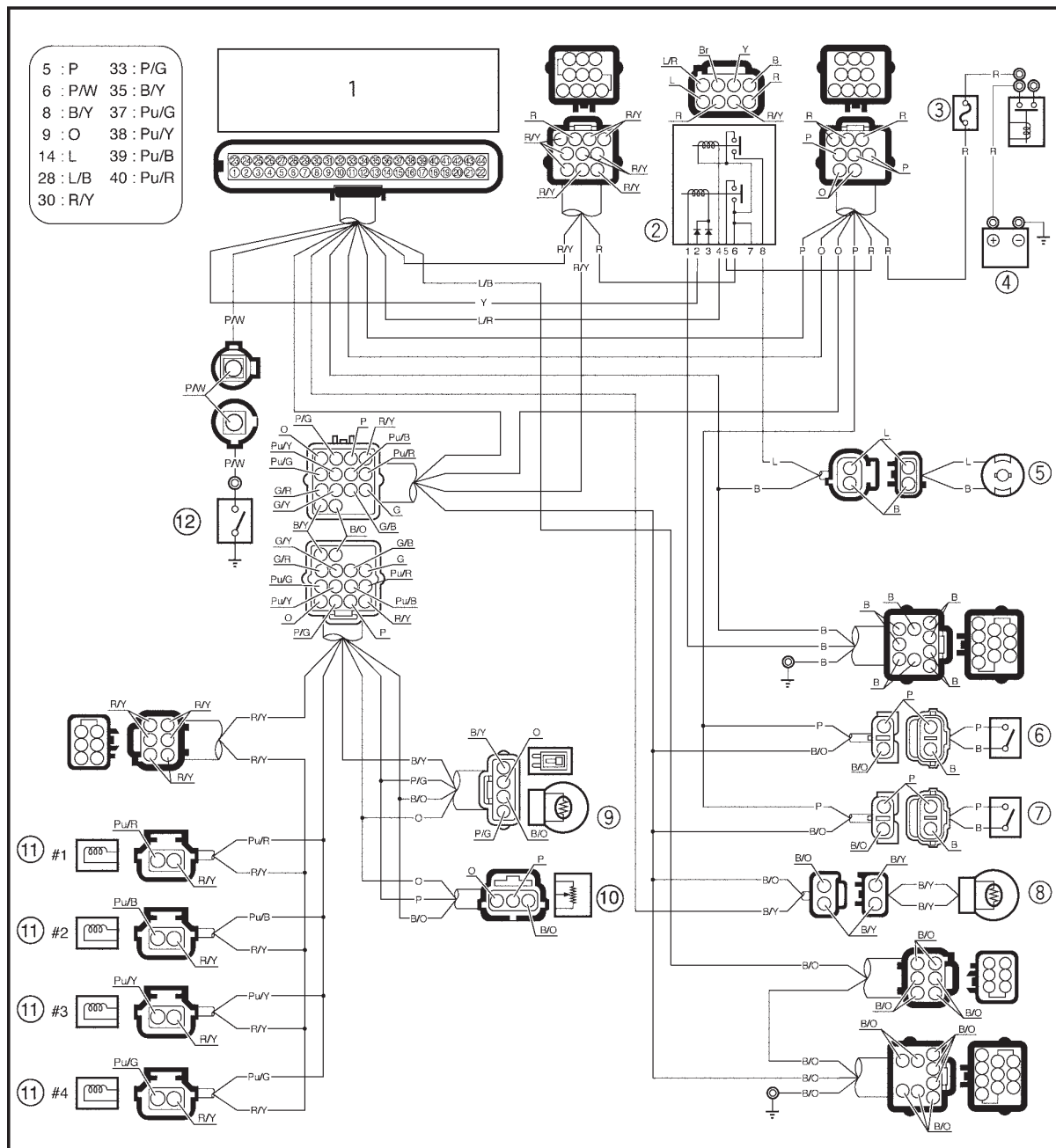
## FUEL CONTROL SYSTEM WIRING DIAGRAM



- |                            |                             |
|----------------------------|-----------------------------|
| ① ECM                      | ⑧ Engine temperature sensor |
| ② Main and fuel pump relay | ⑨ Sensor assembly           |
| ③ Fuse (20A)               | ⑩ Throttle position sensor  |
| ④ Battery                  | ⑪ Fuel injector             |
| ⑤ Fuel pump                | ⑫ Oil pressure switch       |
| ⑥ Thermoswitch (exhaust)   |                             |
| ⑦ Thermoswitch (engine)    |                             |



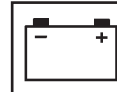
## FUEL CONTROL SYSTEM (Cont'd.) WIRING DIAGRAM



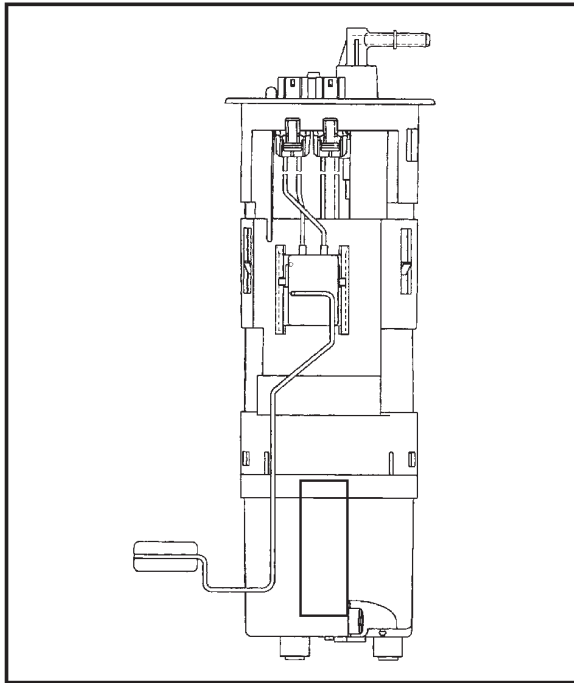
B : Black  
Br : Brown  
G : Green  
L : Blue  
O : Orange  
P : Pink  
R : Red  
W : White  
Y : Yellow

B/O : Black/orange  
B/Y : Black/yellow  
G/O : Green/orange  
L/B : Blue/black  
L/R : Blue/red  
P/G : Pink/green  
P/W : Pink/white  
Pu/B : Purple/black  
Pu/G : Purple/green

Pu/R : Purple/red  
Pu/Y : Purple/yellow  
R/Y : Red/yellow  
W/R : White/red



## FUEL CONTROL SYSTEM (Cont'd.)



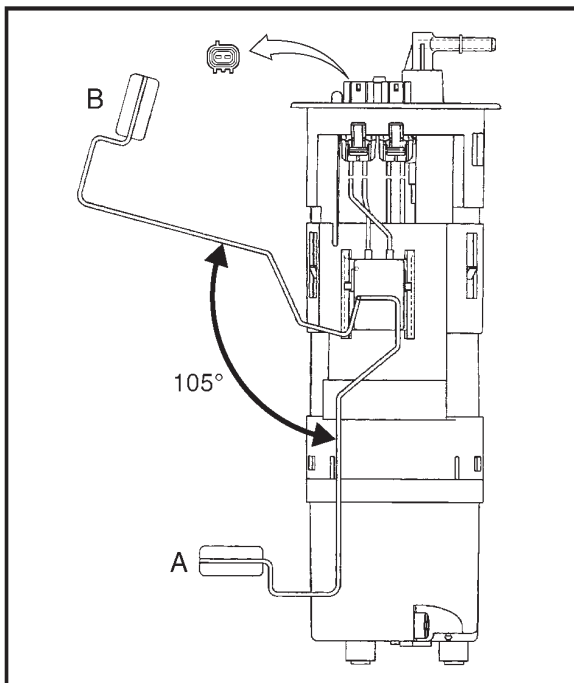
## FUEL PUMP

## 1. Check:

- Fuel pump operating sound  
Fuel pump does not sound → Measure the fuel pressure.  
Refer to “FUEL INJECTION SYSTEM” in Chapter 4.

**NOTE:**


After the engine is stopped, the fuel pump will operate for 10 seconds.

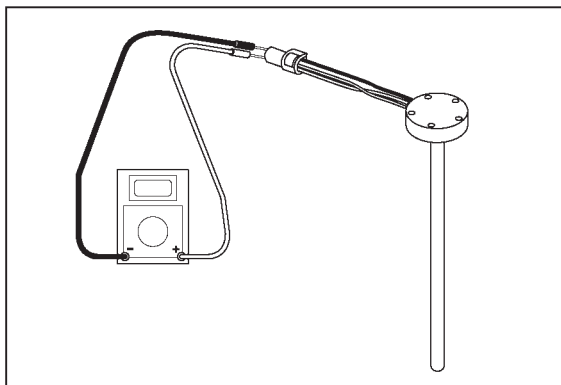
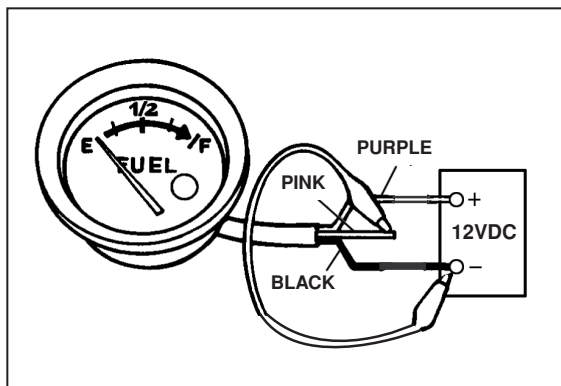
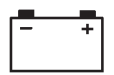


## FUEL SENDER

## 1. Measure:

- Fuel sender resistance  
Out of specification → Replace.

 Float position	Resistance ( $\Omega$ )
A	133.5–136.5
B	5–7



## FUEL GAUGE

- Check:
  - Indication  
Out of specification → Replace.

Fuel Meter Indication:		
Indication	Jumper Leads	
	Pink	Black
"F"	○	○
"E"		

**NOTE:** \_\_\_\_\_  
The meter should be battery powered for this inspection.

## FUEL GAUGE, LOW FUEL LED AND WIRING CHECK

- Open the fuel hatch and locate the three wire connector for the Fuel Sensor. Unplug the sensor's connector and turn the starboard key to the "ON" position. The gauge should then read below "EMPTY" and the Low Fuel LED should be illuminated.



- Put the black lead of a voltmeter on the Black/White wire of the harness. Then use the red lead of the voltmeter to measure the voltage on the other two pins.

PURPLE = More than +12 VDC (or close to Battery terminal voltage)

PINK = More than +7 VDC (sensor disconnected).

- If the above voltages are as indicated turn the key off and insert a jump lead between the PINK and BLACK/WHITE pins of the harness connector to ground. Turn the starboard key on. The gauge should read above the "FULL" mark.
- If the test voltages were incorrect, check continuity of the wire harness between the sensor connector and the corresponding wires at the back of the fuel gauge. (See Connector Wiring chart below)
- If the harness wiring is correct then test the gauge by connecting a 12VDC power source to the PURPLE wire connector and jumping the PINK to BLACK wire connectors to ground. The gauge needle should read above the "FULL" mark. If it does not read above Full, replace the gauge.

#### CONNECTOR WIRING

Signal	Sender	Harness	Gauge
Positive (12V)	Red	Purple	Purple
Ground	Black	Blk/Wht	Black
Send	White	Pink	Pink

#### FUEL LEVEL SENSOR/LOW FUEL SWITCH

The Fuel Level Sensor and Low Fuel Switch are tested by eliminating other causes. Test the gauge, low fuel LED and wiring as above in the "Fuel Gauge" section. If the gauge and wiring are normal then replace the Fuel Sensor.

**NOTE:** If the Fuel Gauge reads "FULL" on a partially full tank (less than 3/4 full) then the problem may be due to collected water in bottom of the tank. Inspect the tank, drain and clean if water is found.

#### FUEL INJECTOR

Refer to "FUEL INJECTION SYSTEM" in Chapter 4.

#### MAIN AND FUEL PUMP RELAY

Refer to "IGNITION SYSTEM."

#### OIL PRESSURE SWITCH

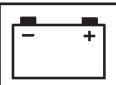
Refer to "IGNITION SYSTEM."

#### THERMOSWITCH (ENGINE)

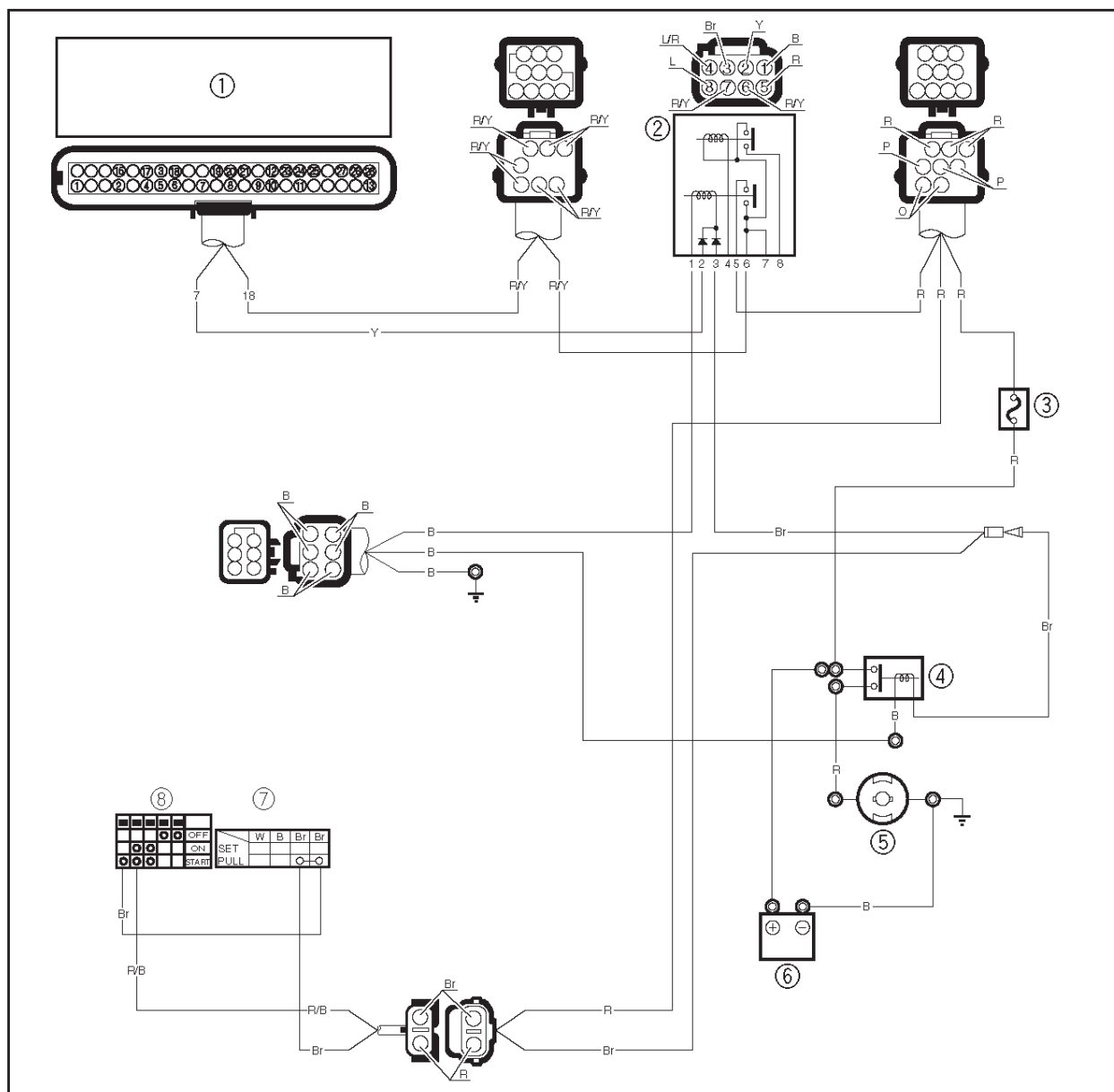
Refer to "IGNITION SYSTEM."

#### THERMOSWITCH (EXHAUST)

Refer to "IGNITION SYSTEM."



## STARTING SYSTEM WIRING DIAGRAM



- ① ECM
- ② Main and fuel pump relay
- ③ Fuse (20A)
- ④ Starter relay
- ⑤ Starter motor
- ⑥ Battery
- ⑦ Start switch
- ⑧ Engine shut-off switch

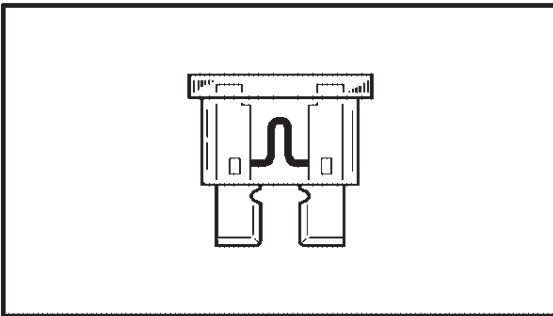
- B : Black
- Br : Brown
- R : Red
- Y : Yellow
- R/Y : Red/yellow

**BATTERY**

Refer to "ELECTRICAL" in Chapter 3.

**WIRING CONNECTIONS**

1. Check:
  - Wiring connections
 Poor connections → Properly connect.

**FUSE**

1. Check:
  - Fuse broken
 Broken → Replace.



**Fuse rating:**  
**3A, 20A**

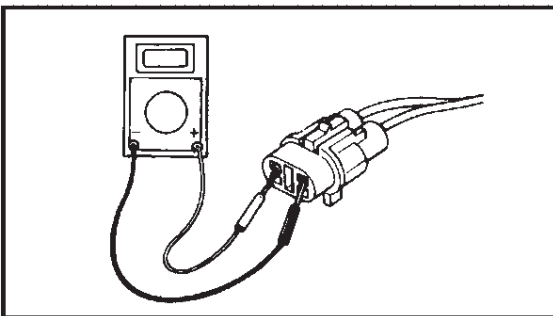
**NOTE:**

20A fuse is for main relay, engine shut-off switch and rectifier/regulator.

3A fuse is for multifunction meter and electric bilge pump.

**KEY SWITCH**

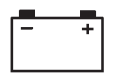
1. Check:
  - Continuity
 Out of specification → Replace.

**Start continuity**

	Brown	Red/Black	White	Black	Purple
OFF				○ — ○	
ON	○ — ○				
START	○ — ○	○ — ○	○ — ○		

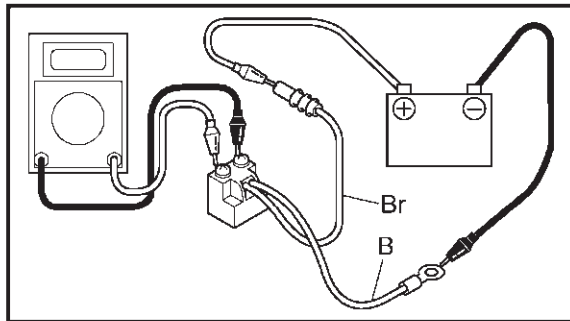
1. Disconnect switch at harness.
2. Turn key to function to be checked.
3. Check continuity between the indicated wire leads.  
No continuity → Replace switch assembly.



**STARTER RELAY**

## 1. Inspect:

- Brown lead terminal
  - Black lead terminal
- Loose → Tighten.

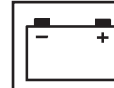


## 2. Check:

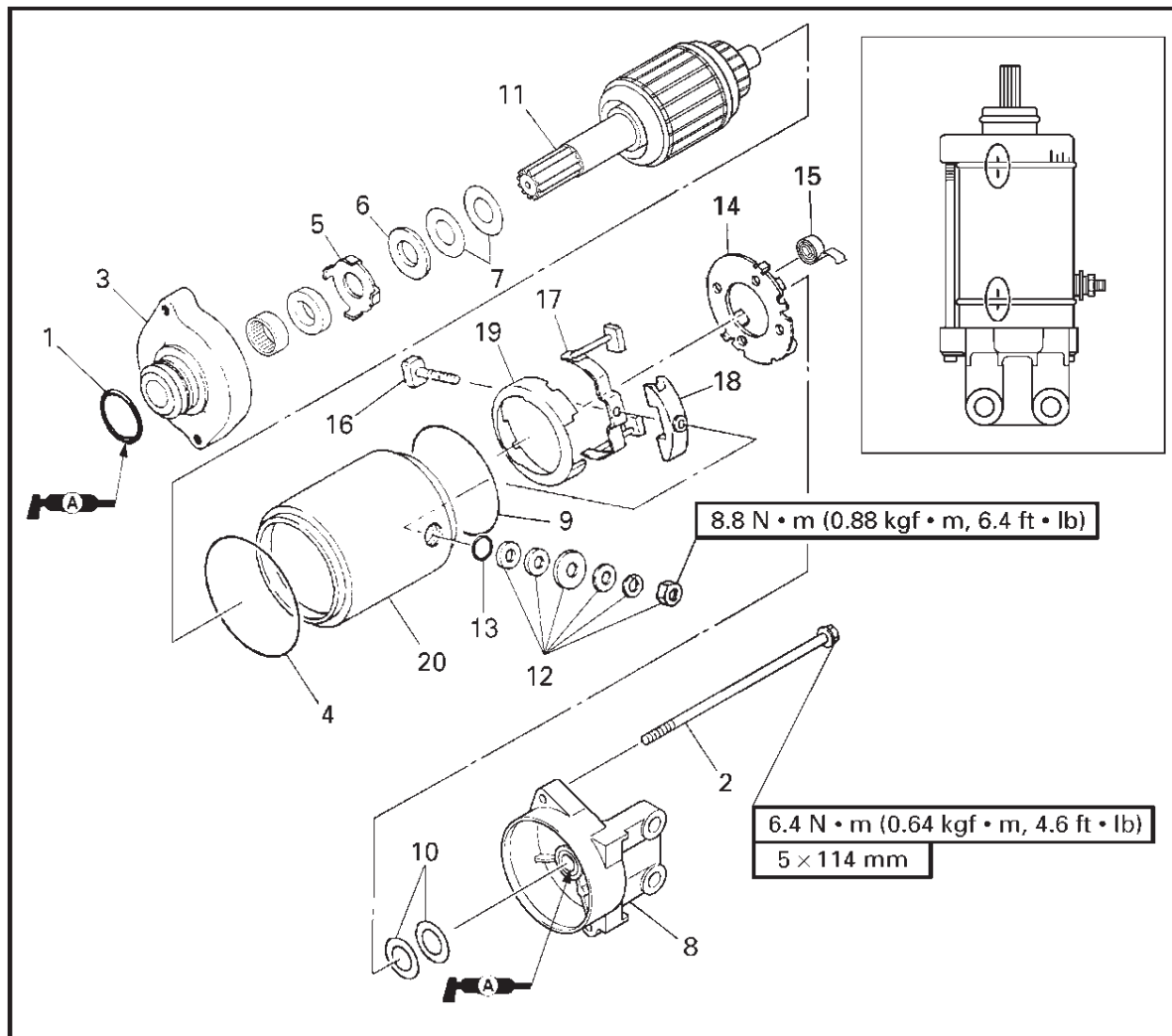
- Starter relay
- Faulty → Replace.

**Checking steps:**

- Connect the tester leads between the starter relay terminals as shown.
- Connect the brown lead terminal to the positive battery terminal.
- Connect the black lead terminal to the negative battery terminal.
- Check that there is continuity between the starter relay terminals.
- Check that there is no continuity after the brown or black lead is removed.



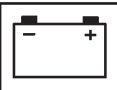
## STARTER MOTOR EXPLODED DIAGRAM



## REMOVAL AND INSTALLATION CHART

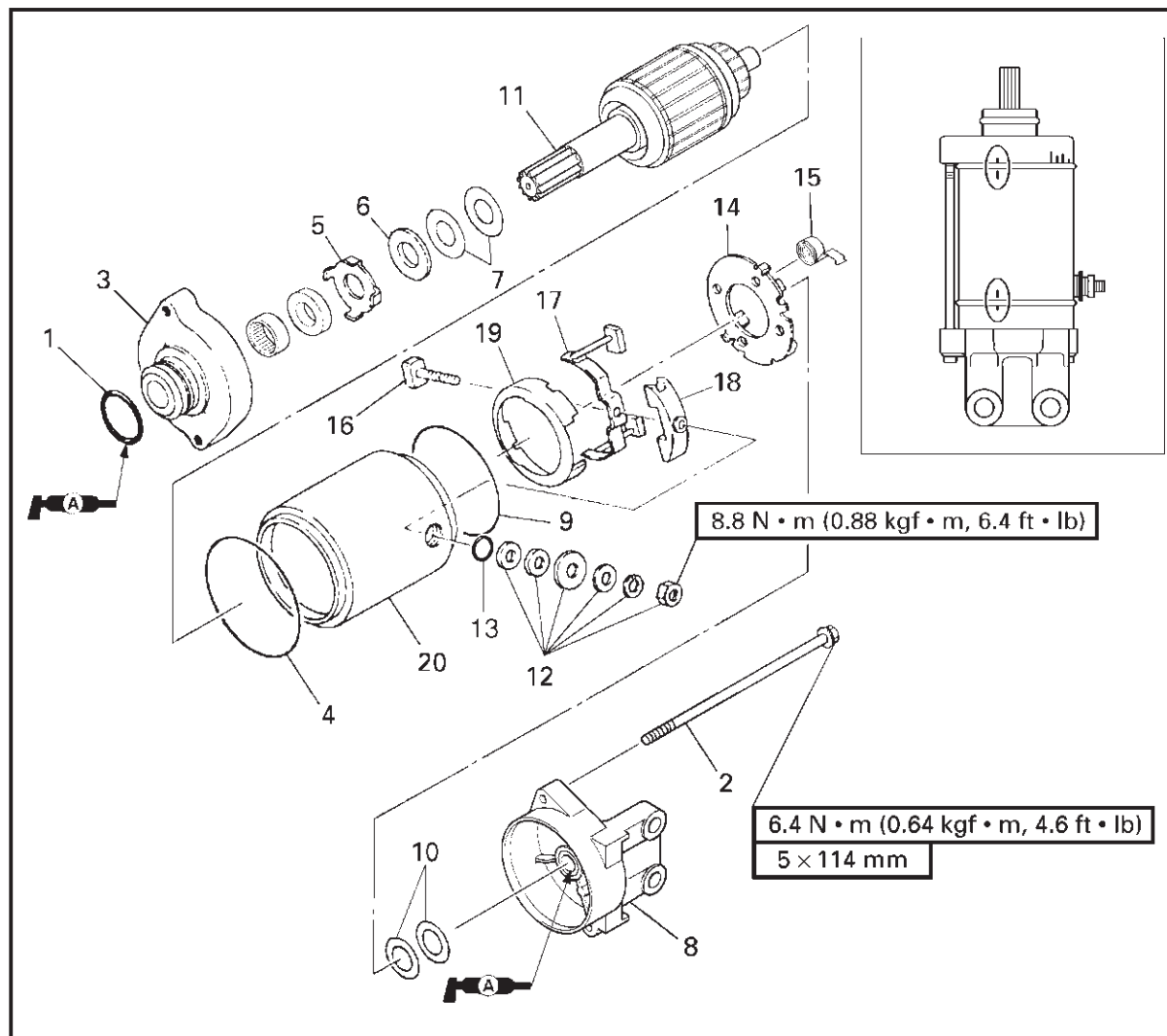
Step	Procedure/Part name	Q'ty	Service points
	<b>STARTER MOTOR DISASSEMBLY</b>		Follow the left "Step" for disassembly.
	Starter motor		Refer to "GENERATOR AND STARTER MOTOR" in Chapter 5.
1	O-ring	1	<b>Not reusable</b>
2	Bolt	2	
3	Starter motor front cover	1	
4	O-ring	1	<b>Not reusable</b>
5	Oil seal retainer	1	
6	Washer	1	
7	Shim	*	t = 0.2 mm, 0.5 mm

\*: As required



## STARTER MOTOR (Cont'd.)

## EXPLODED DIAGRAM

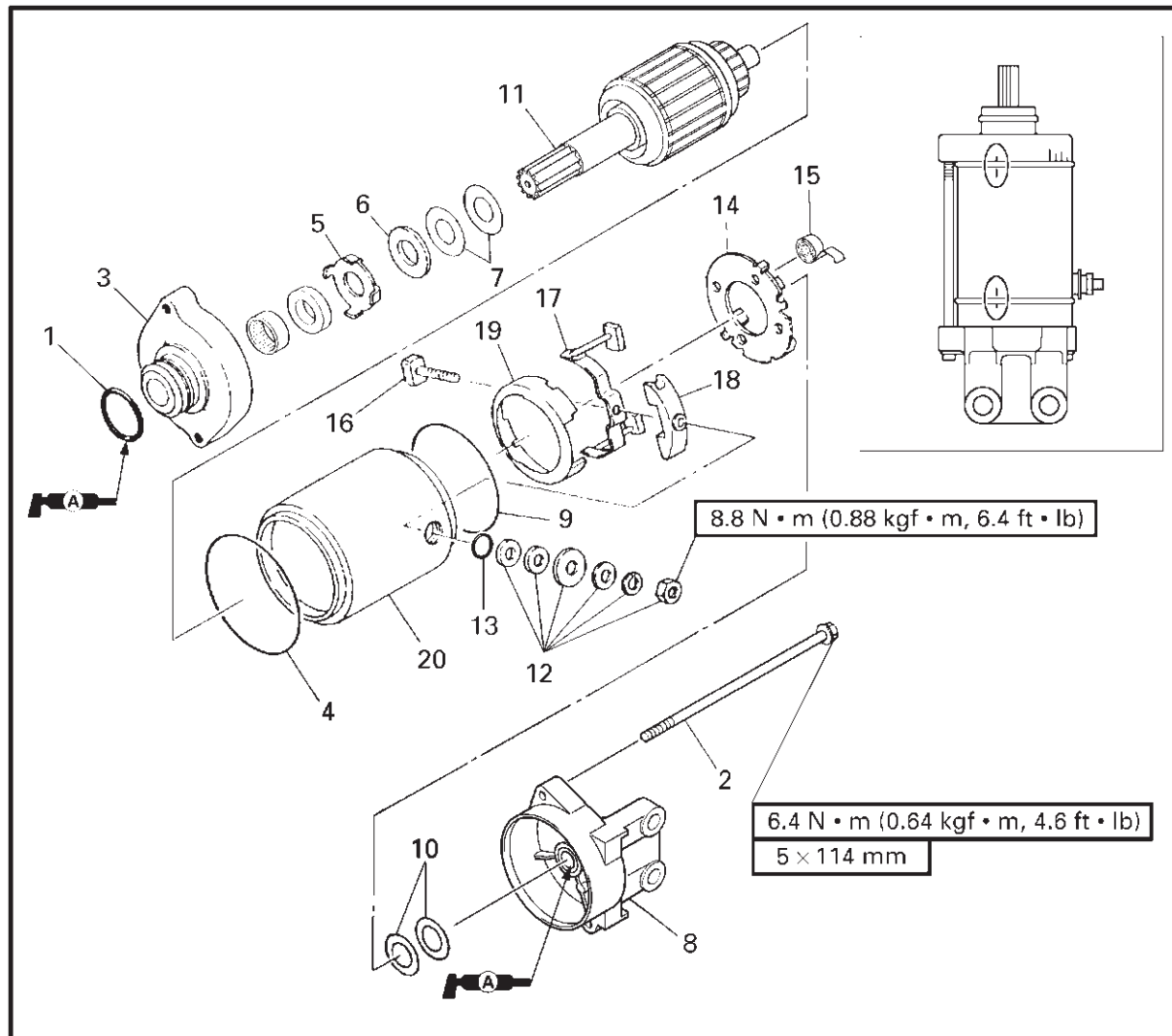


Step	Procedure/Part name	Q'ty	Service points
8	Starter motor rear cover	1	
9	O-ring	1	<b>Not reusable</b>
10	Shim	*	t = 0.2 mm, 0.8 mm
11	Armature assembly	1	
12	Nut/spring washer/washer	1/1/4	
13	O-ring	1	<b>Not reusable</b>
14	Brush holder	1	
15	Brush spring	4	
16	Bolt	1	
17	Brush assembly	1	

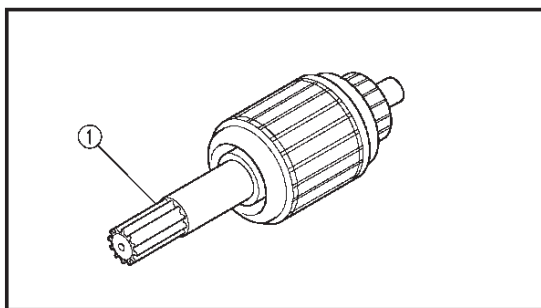
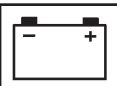


## STARTER MOTOR (Cont'd.)

## EXPLODED DIAGRAM

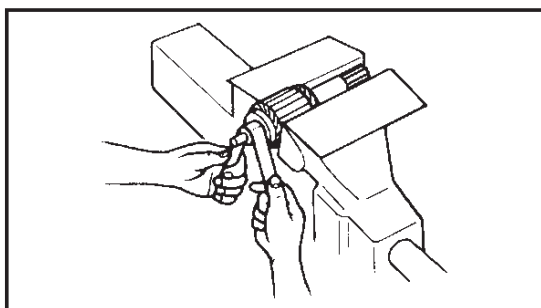


Step	Procedure/Part name	Q'ty	Service points
18	Spacer	1	Reverse the disassembly steps for assembly.
19	Holder	1	
20	Starter motor yoke	1	

**SERVICE POINTS****Armature inspection**

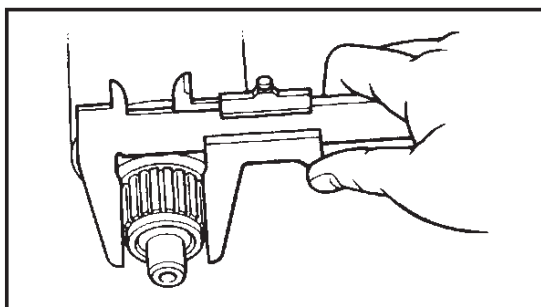
## 1. Inspect:

- Armature shaft ①  
Damage/wear → Replace.



## 2. Inspect:

- Commutator  
Dirt → Clean with 600 grit sandpaper.

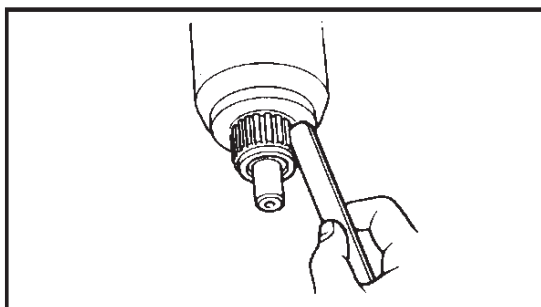


## 3. Measure:

- Commutator diameter  
Out of specification → Replace.



**Min. commutator diameter:**  
27.0 mm (1.06 in)

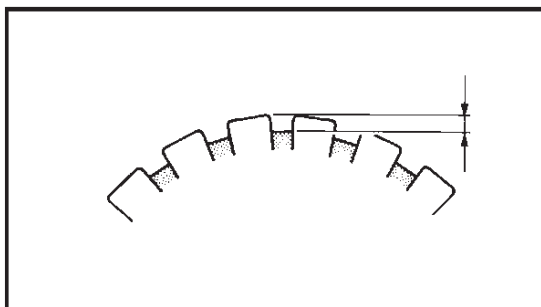


## 4. Check:

- Commutator undercut  
Contaminants → Clean.

**NOTE:**

Remove all mica and metal particles with compressed air.

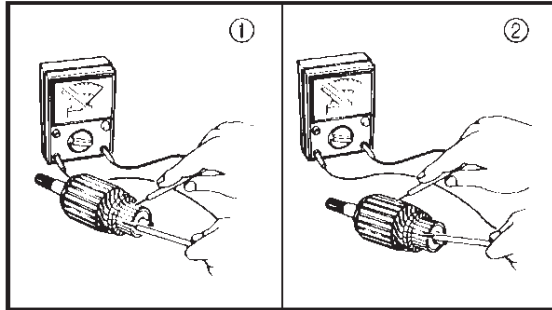
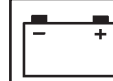


## 5. Measure:

- Commutator undercut  
Out of specification → Replace.



**Min. commutator undercut:**  
0.2 mm (0.01 in)

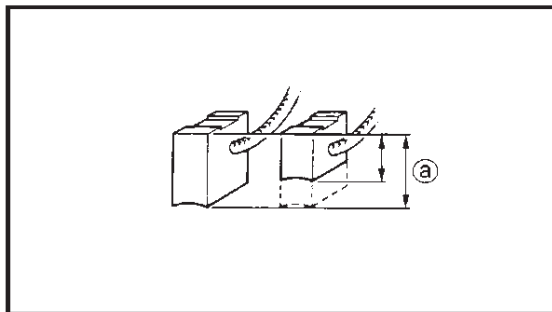


## 6. Inspect:

- Armature coil continuity  
Out of specification → Replace.

**Armature coil continuity:**

Commutator segments ①	Continuity
Segment - Laminations ②	No continuity
Segment - Armature shaft	No continuity

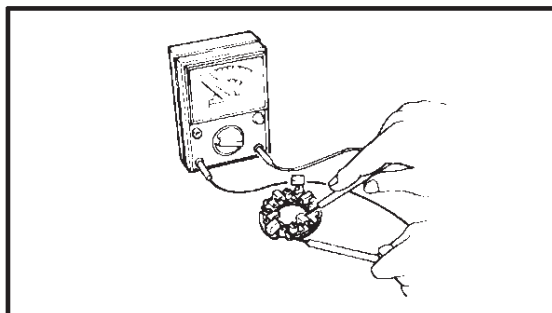
**Brush holder inspection**

## 1. Measure:

- Brush length ①  
Out of specification → Replace.



**Min. brush length:**  
6.5 mm (0.26 in)

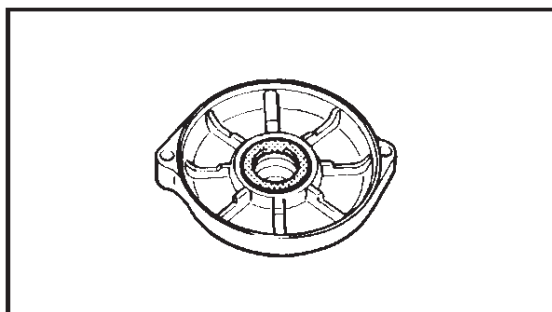


## 2. Check:

- Brush holder continuity  
Out of specification → Replace.

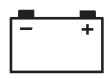
**Brush holder continuity:**

Brush holder - Base	No continuity
---------------------	---------------

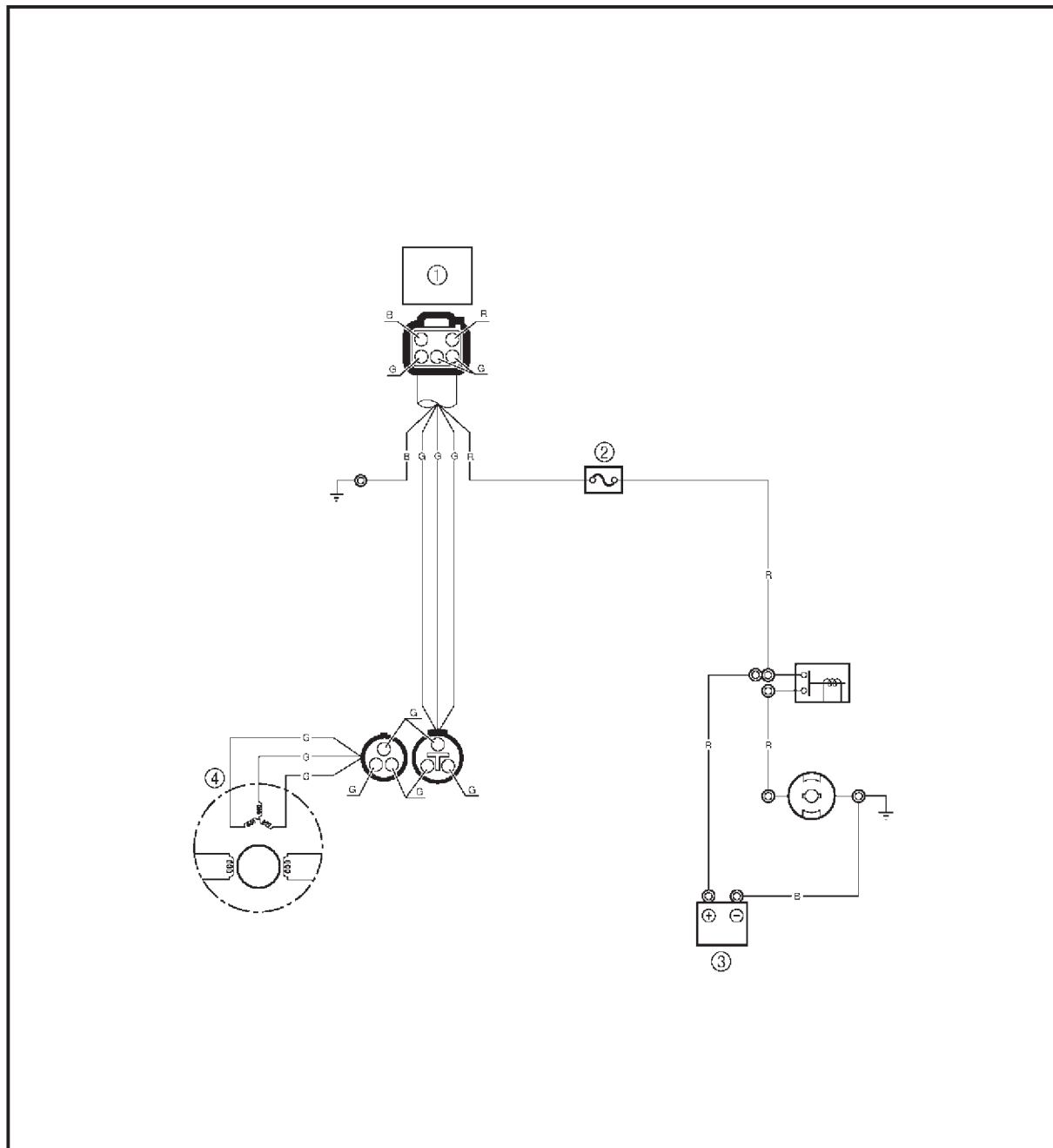
**Starter motor front cover inspection**

## 1. Inspect:

- Starter motor front cover oil seal  
Damage/wear → Replace the starter motor front cover.

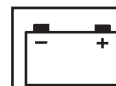


## CHARGING SYSTEM WIRING DIAGRAM



- ① Rectifier/regulator
- ② Fuse (20A)
- ③ Battery
- ④ Lighting coil

B : Black  
G : Green  
R : Red

**FUSE**

Refer to "STARTING SYSTEM."

**BATTERY**

Refer to "ELECTRICAL" in Chapter 3.

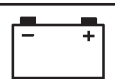
**LIGHTING COIL**

Refer to "IGNITION SYSTEM."

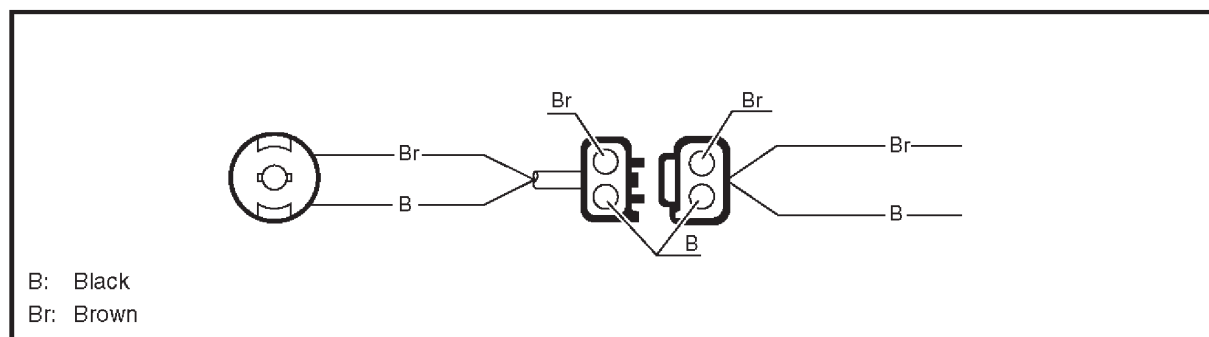
**RECTIFIER/REGULATOR**

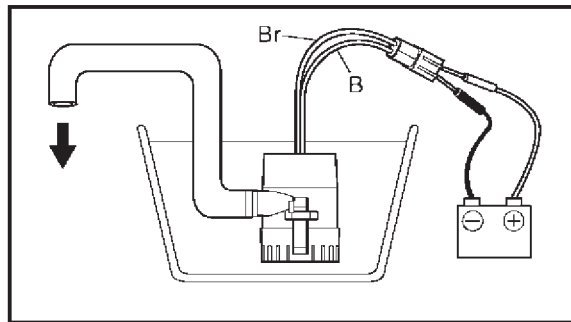
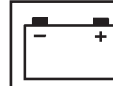
Refer to "IGNITION SYSTEM."





## ELECTRIC BILGE PUMP WIRING DIAGRAM

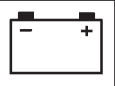


**ELECTRIC BILGE PUMP****1. Check:**

- Electric bilge pump operation  
Incorrect → Replace.

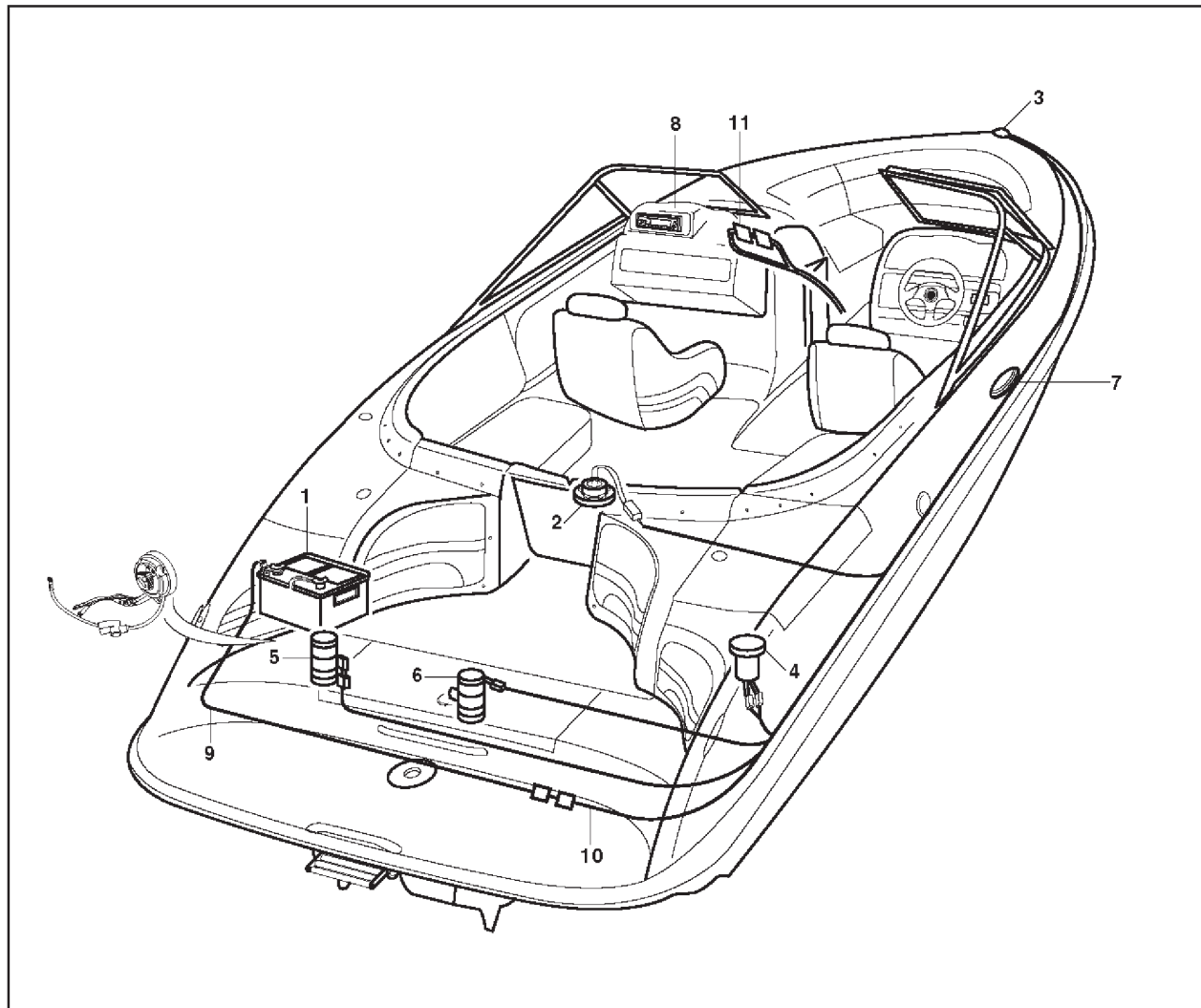
**Checking steps:**

- Suspend the electric bilge pump in a container filled with water.
- Connect the brown lead terminal to the positive battery terminal.
- Connect the black lead terminal to the negative battery terminal.
- Check the water flows from the electric bilge pump hose.



## MAIN COMPONENT LOCATION

### EXPLODED DIAGRAM

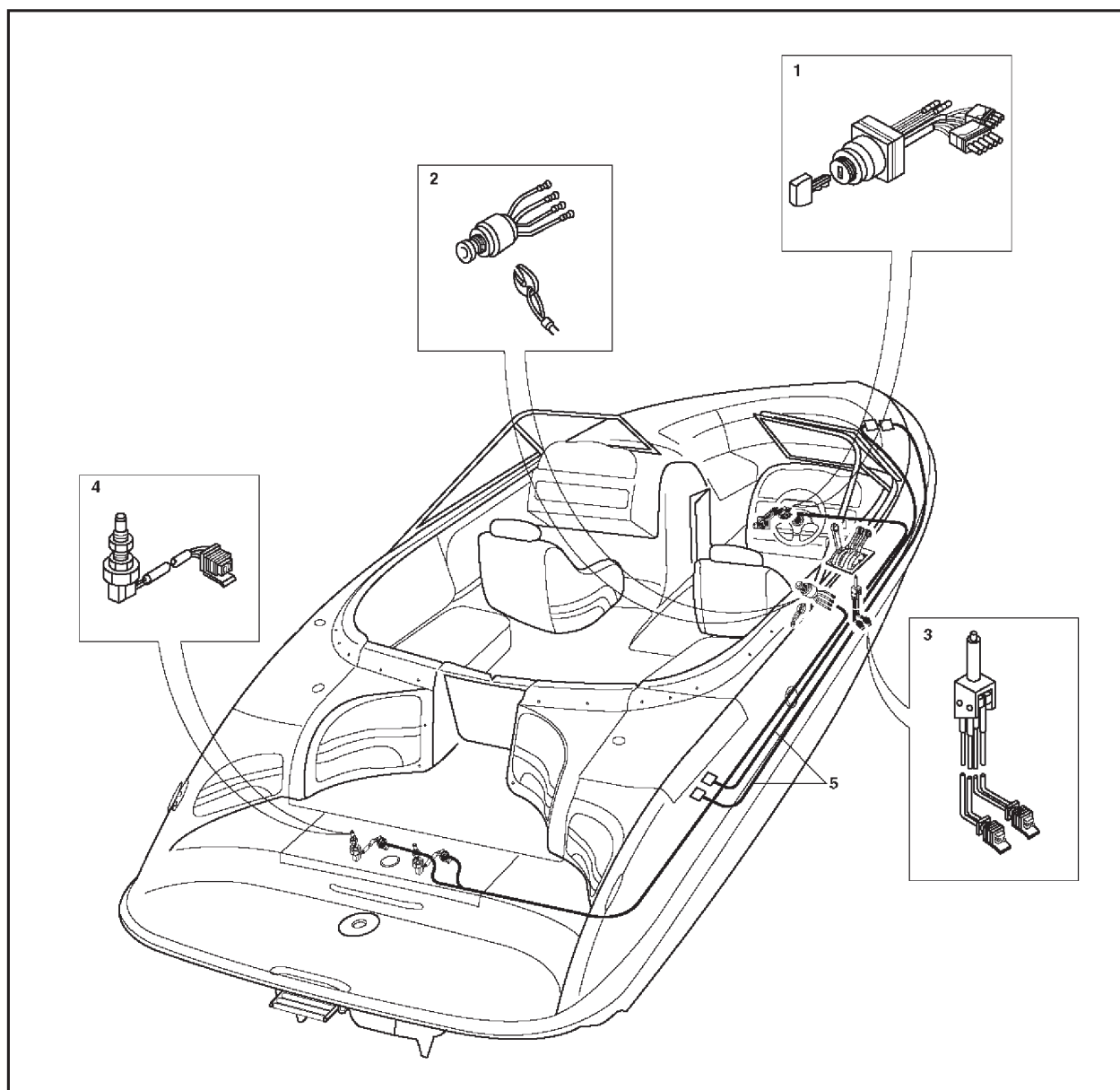


1. Battery
2. Fuel Level Sensor
3. Bow Light
4. Stern Light Connector
5. Blower Motors
6. Bilge Pump
7. Horn
8. Stereo Unit
9. Hull Harness #3
10. Deck Harness
11. 12V Outlet and Circuit Breaker

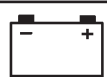


## SWITCH LOCATION

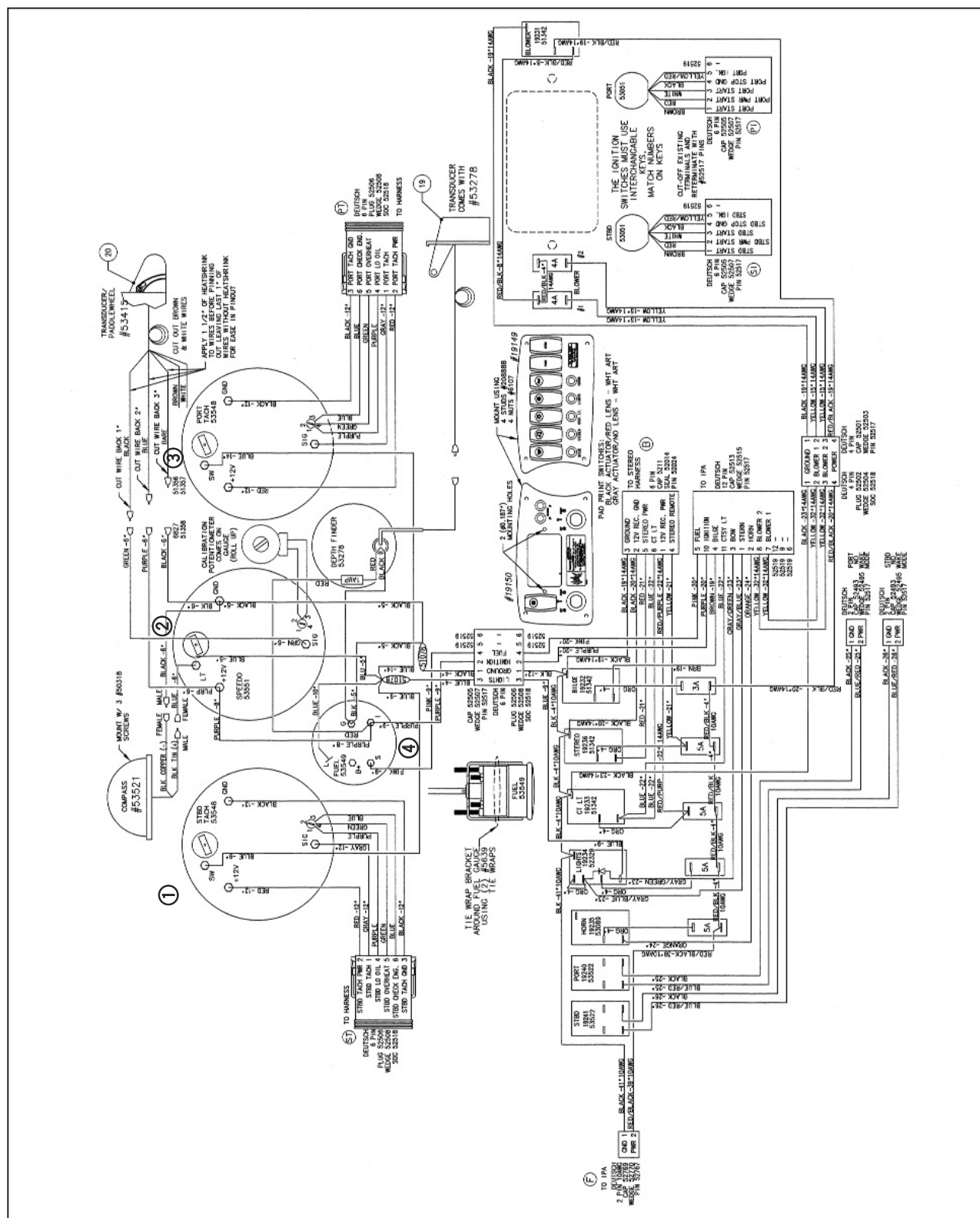
### WIRING DIAGRAM



1. Key Switches
2. Lanyard Switch
3. Neutral Switch
4. Hatch Interlock Switches
5. Engine Harness #2

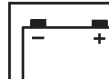


## METER PANEL BACK VIEW (AR230 HO) - WIRING DIAGRAM

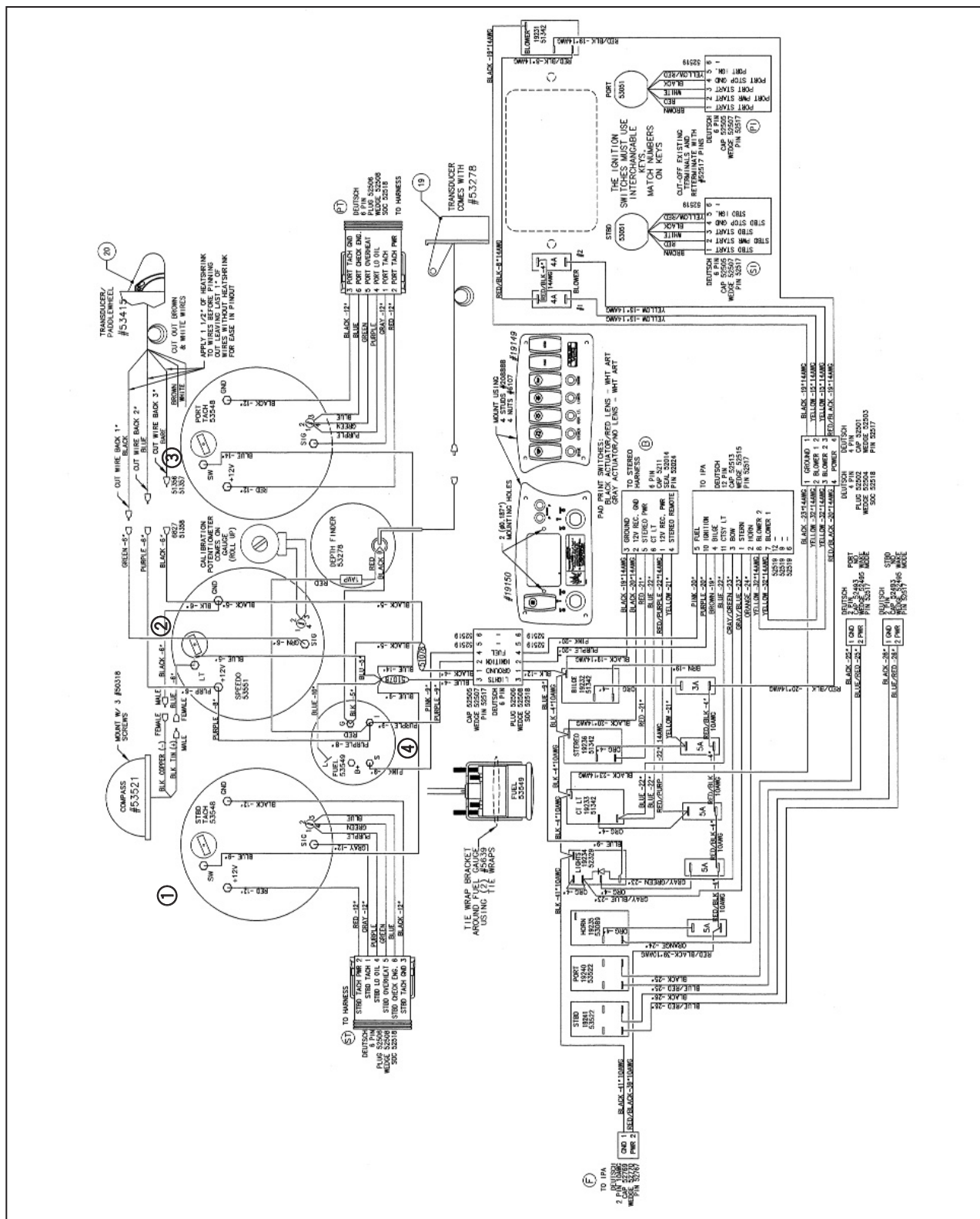


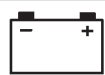
- ① Starboard Tach
- ② Speedometer

- ③ Port Tach
- ④ Fuel Gauge

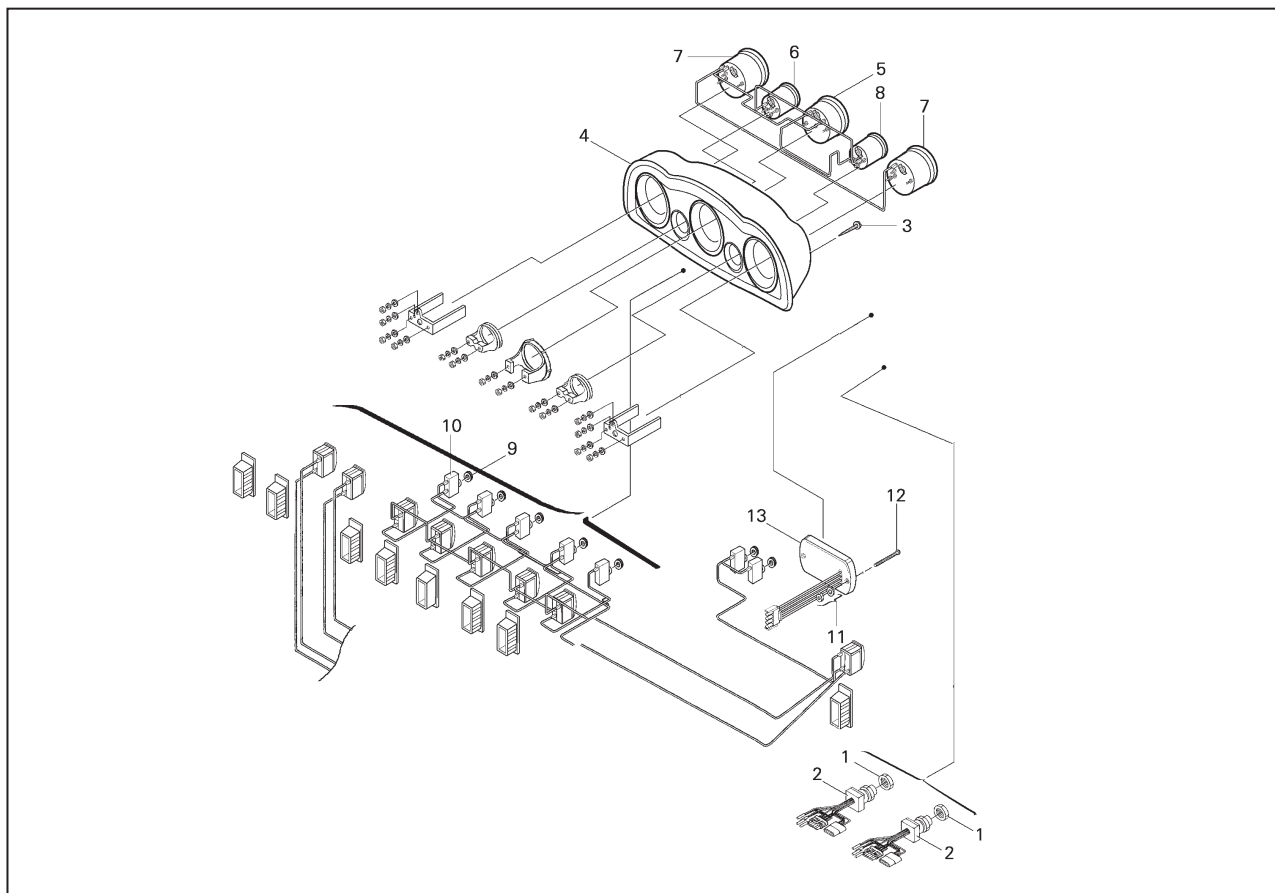


## METER PANEL BACK VIEW (SX230 HO) - WIRING DIAGRAM



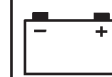


## METER PANEL EXPLODED DIAGRAM



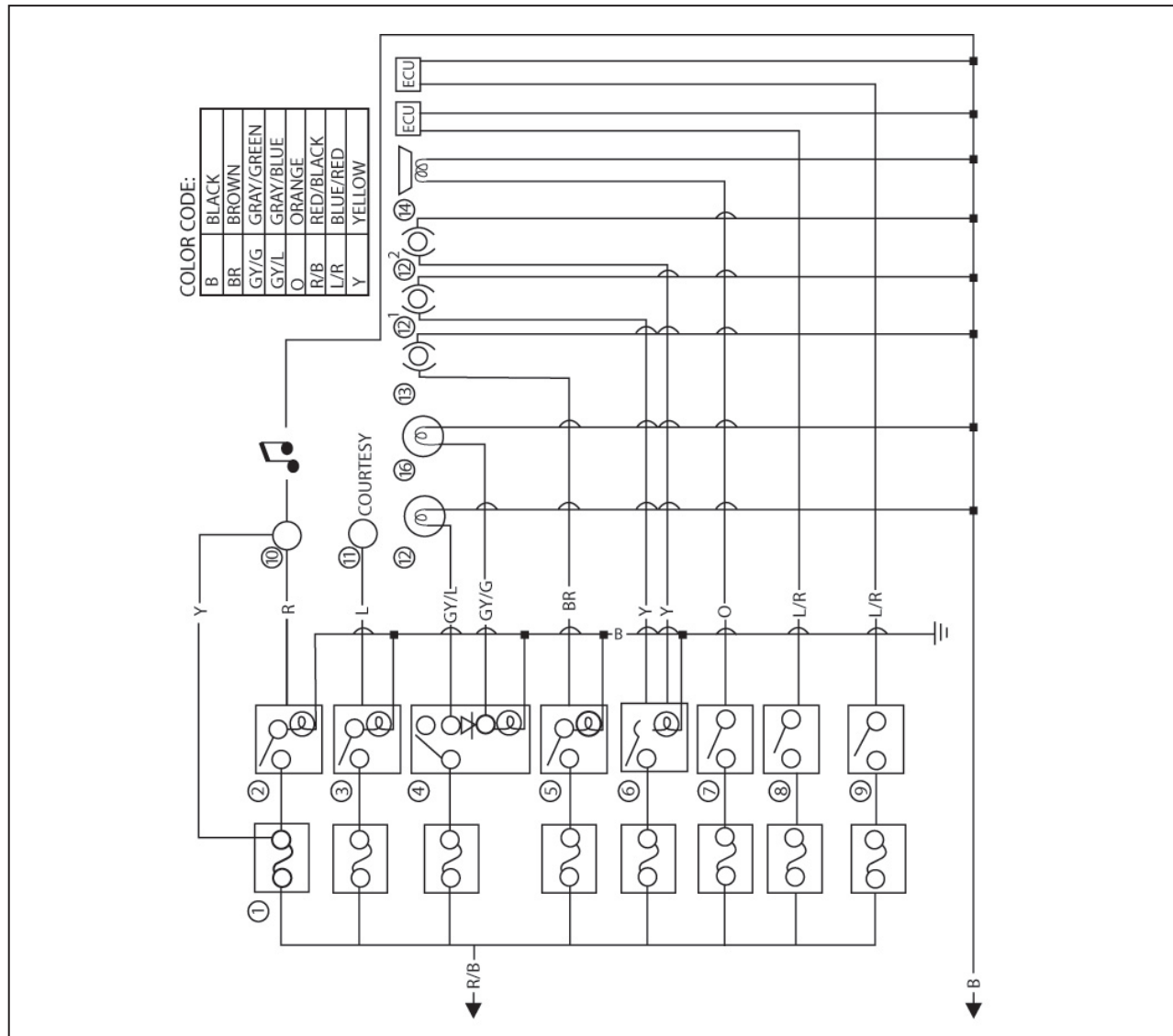
## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Qty (ea.)	Service Points
	<b>METER PANEL DISASSEMBLY</b>		Follow the "Step" order for removal.
1	Nut	2	20-3/4 x 2"
2	Key Switch	2	
3	Screw	4	
4	Meter Panel	1	
5	Speedometer	1	
6	Fuel Gauge	1	
7	Tachometer	1	
8	Depth Sounder	1	
9	Nut	7	6-32 x 1"
10	Breaker	7	
11	Nut and Washer	2	
12	Screw	2	
13	Controller, Stereo	1	
			Reverse the removal steps for installation.



## SWITCH AND COMPONENT

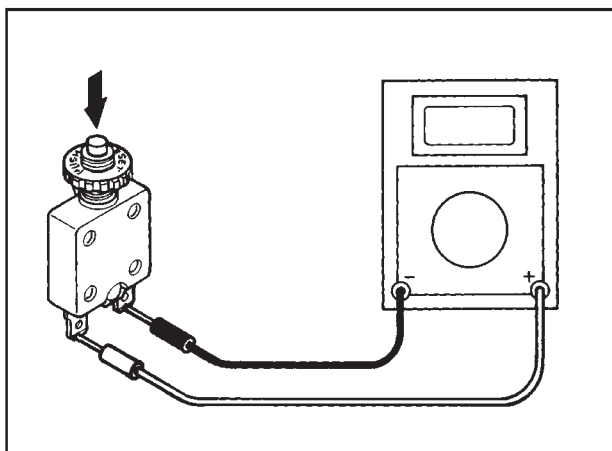
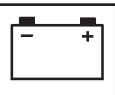
## WIRING DIAGRAM



- ① Circuit Breaker
- ② Stereo Switch
- ③ Courtesy Light Switch
- ④ Navigation Light Switch
- ⑤ Bilge Pump Switch
- ⑥ Blower Switch
- ⑦ Horn Switch
- ⑧ Port No-Wake Switch
- ⑨ Starboard No-Wake Switch

- ⑩ Stereo
- ⑪ Courtesy Lead
- ⑫ Blower Motors
- ⑬ Bilge Pump
- ⑭ Horn
- ⑮ Stern Light
- ⑯ Bow Light



**KEY SWITCH**

Refer to the “STARTING SYSTEM” section.

**CIRCUIT BREAKER**

- Check:
  - Continuity
  - Discontinuity → Replace.

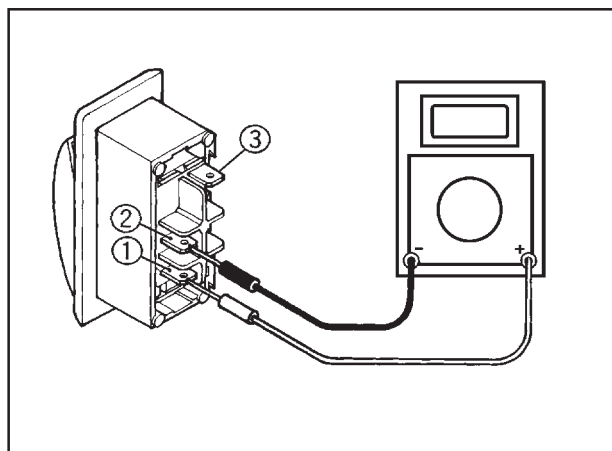
**NOTE:**

Push the button once and recheck it.

**PANEL SWITCHES**

Panel Switch Continuity

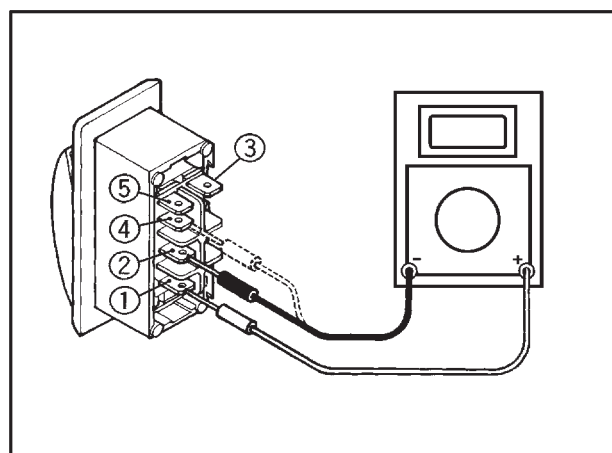
- Check:
  - Continuity
  - Out of specification → Replace.



Panel Switch Continuity: Leads		
	1	2
On	O	O
Off		

Navigation Light Switch Continuity

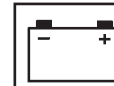
- Check:
  - Continuity
  - Out of specification → Replace.
- Check:
  - Diode
  - No continuity, continuity both directions → Replace.




Navigation Light Switch Continuity: Leads			
	1	2	4
Top in	O	O	
Bottom in		O	O
Off			

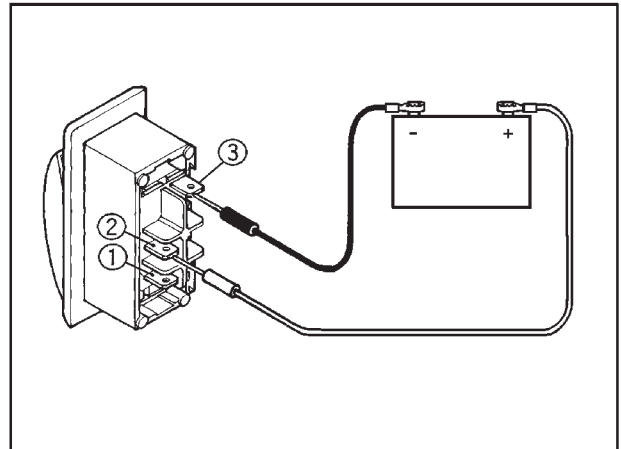
**NOTE:**

The navigation light switch test is with the diode and jumper wire removed.



	Panel Switch Light: Leads	
	2	3
On	O	O
Off		

**NOTE:** The horn switch and no-wake switches have no light.



## BLOWER MOTOR

1. Check:
  - Motor running  
Malfunction →  
Check switch and wiring → Replace.

## BILGE PUMP

1. Check:
  - Turn on switch - pump should cycle for approximately 1 second.  
Malfunction →  
Check switch and wiring → Replace.

---

## CHAPTER 8

### HULL AND DECK

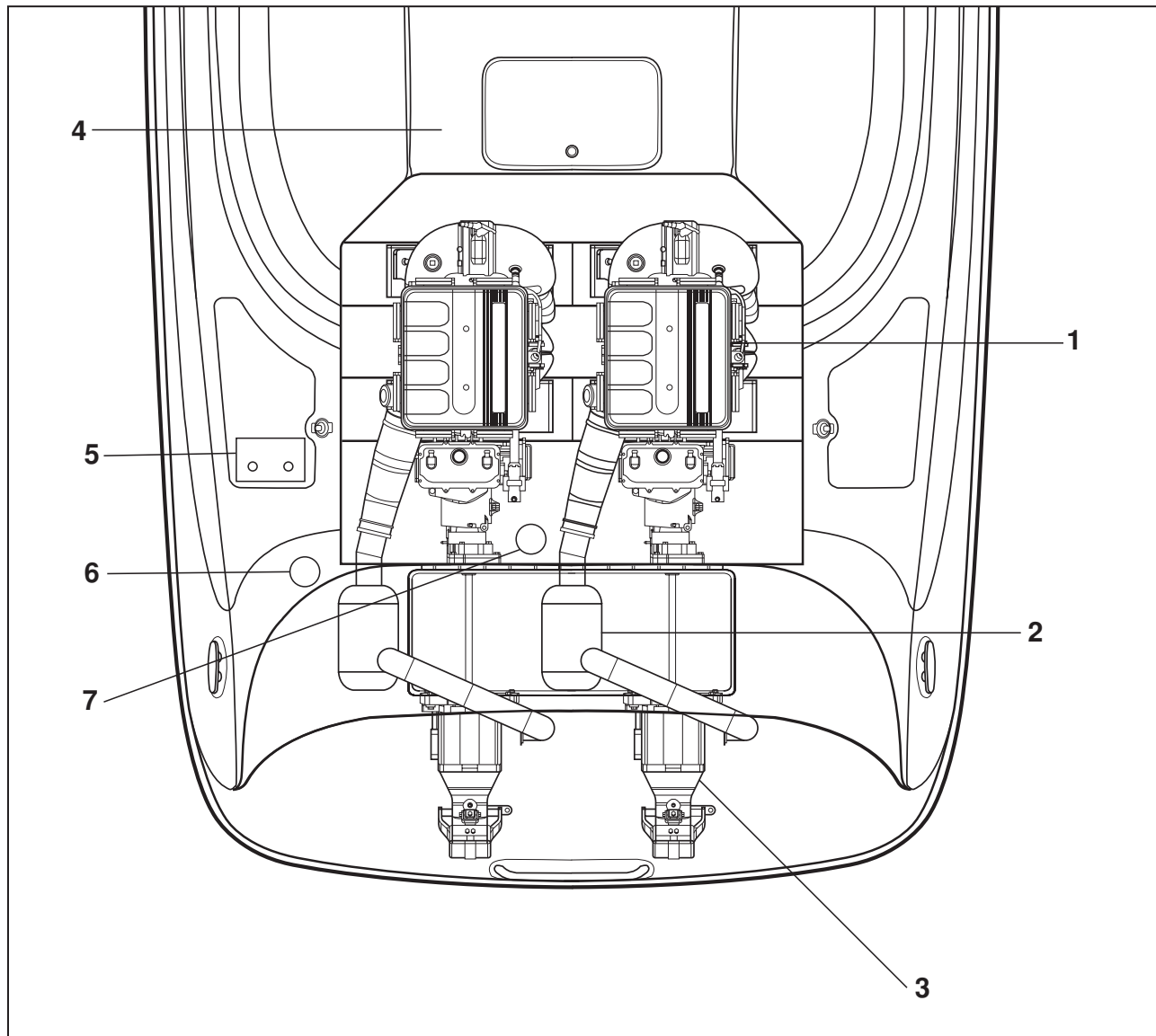
<b>ENGINE COMPARTMENT LAYOUT</b> .....	8-1
EXPLODED DIAGRAM .....	8-1
<b>VENTILATION SYSTEM</b> .....	8-2
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## ENGINE COMPARTMENT LAYOUT EXPLODED DIAGRAM

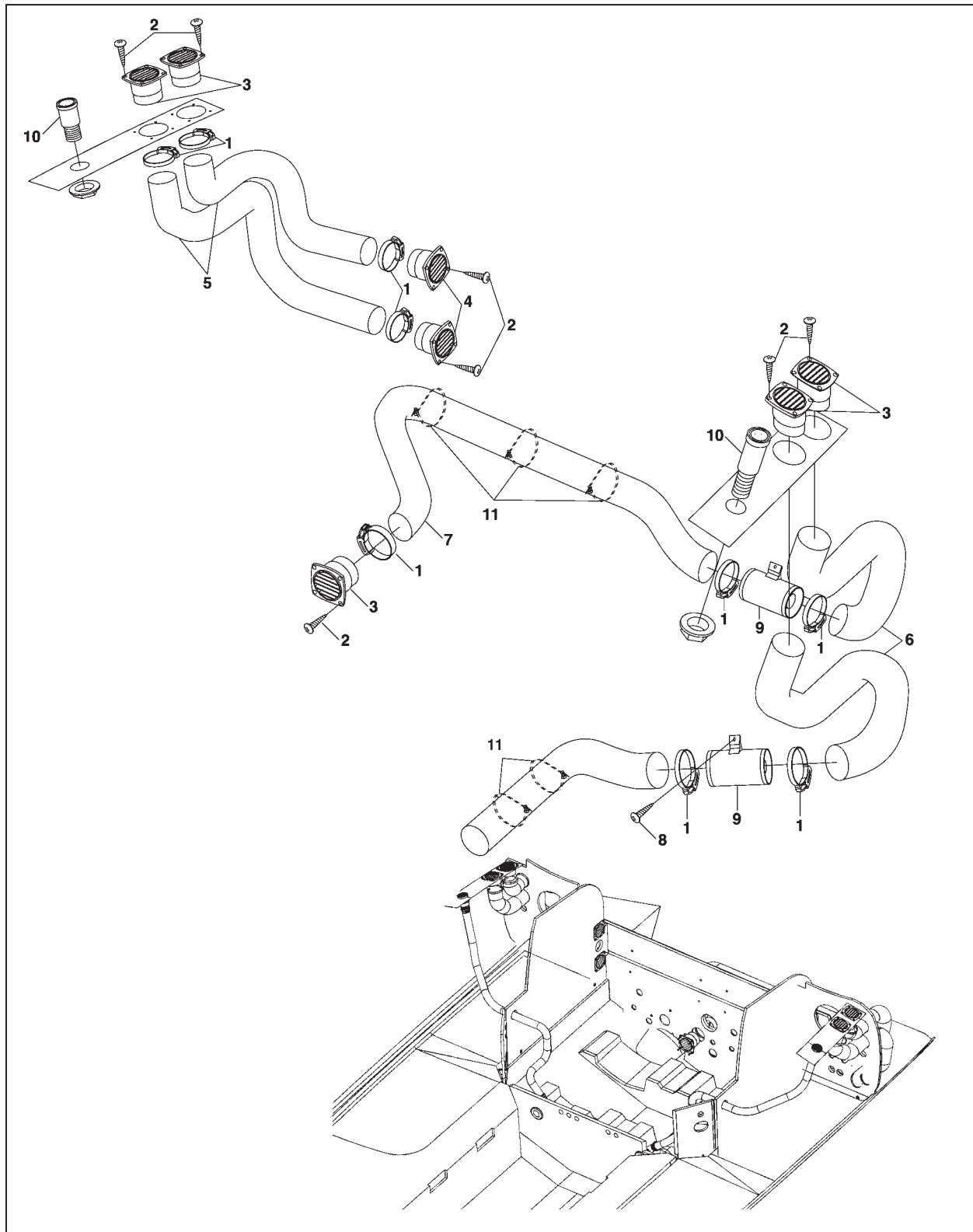


- 1. Engine
- 2. Water Lock
- 3. Jet Pump
- 4. Fuel Tank

- 5. Battery
- 6. Blowers
- 7. Bilge Pump



## VENTILATION SYSTEM EXPLODED DIAGRAM



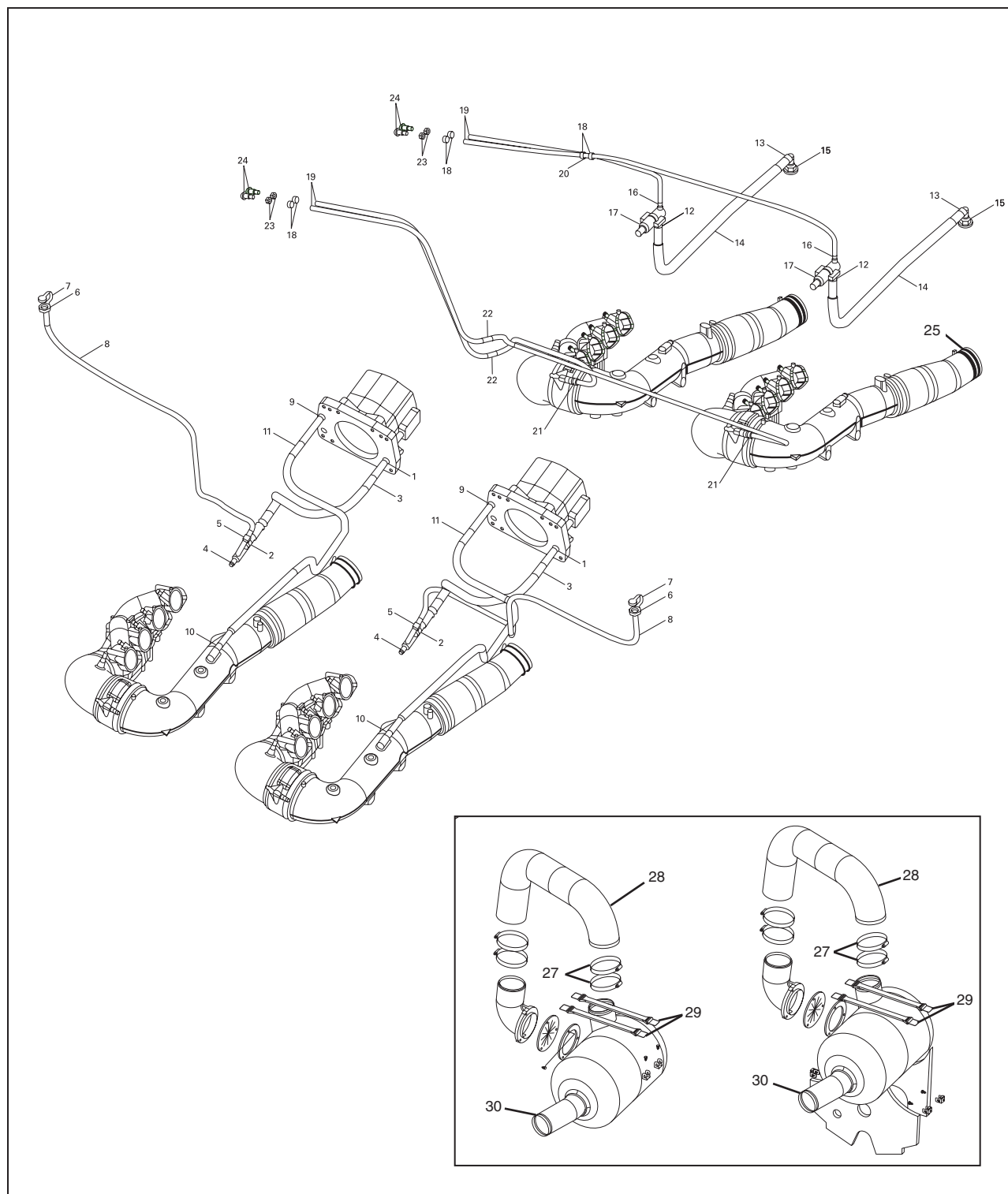


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>VENTILATION SYSTEM DISASSEMBLY</b>		Follow the "Step" order for removal.
1	Hose Clamp	11	Snap type
2	Screw, Oval Head Tapping	28	
3	Ventilator (White)	5	
4	Ventilator (Black)	2	Intake 36" Exhaust 24"
5	Hose, Ventilation	3	
6	Hose, Ventilation	2	
7	Hose, Ventilation	1	
8	Screw, Truss Head Tapping	4	
9	Blower Assembly	2	
10	Ventilator	2	
11	Band	4	
12	Hose, Ventilation 2	2	
13	Joint, Drain	2	
14	Clamp, Cable	5	
			Reverse the removal steps for installation.



## COOLING SYSTEM EXPLODED DIAGRAM





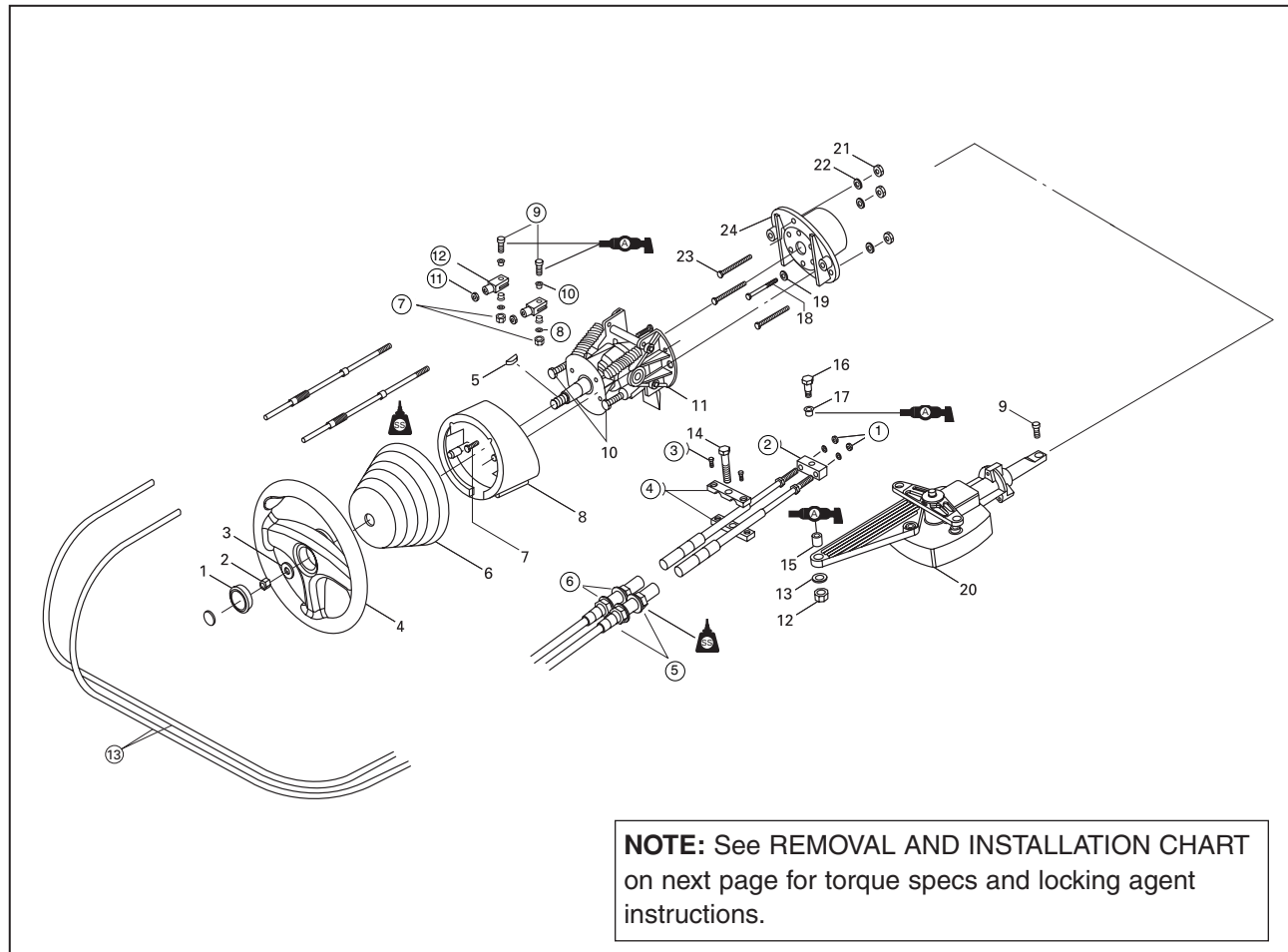


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>COOLING SYSTEM AND WATER LOCK REMOVAL</b>		Follow the "Step" order for removal.
1	Band, Hose 18	2	
2	Clip	2	
3	Hose 1	2	
4	Joint, Hose 1	2	
5	Clip	2	
6	Nut	2	
7	Cap, 1	2	
8	Joint Assy	2	
9	Band, Hose 18	2	
10	Clip	2	
11	Hose (L=1250)	2	
12	Clip	2	
13	Band, Hose 18	2	
14	Hose (L=900)	2	
15	Floor, Drain	2	Apply clear silicone around the flange of the fitting.
16	Clip	2	
17	Housing, Thermostat	2	
18	Band, Hose	6	Oetiker type clamps.
19	Hose 8	2	
20	Joint, Pipe	2	Straight connector for Port pilot water hose.
21	Clip	2	
22	Hose	2	STARBOARD hose is shortened to fit.
23	Nut, M14-1.5mm	4	
24	Pilot, Water	4	Apply clear silicone around the flange of the water pilots.
25	Band, Hose	1	Located in engine compartment
26	Clean-out Tray Assembly	1	See pg. 6-6 "Jet Pump Clean-out Tray Removal"
27	Band, Hose	2	
28	Hose, Exhaust Outlet	1	
29	Strap	2	
30	Water Lock	1	Apply soapy water to inside of hose ends on reassembly so that hoses seat completely on Water Lock



## STEERING SYSTEM EXPLODED DIAGRAM



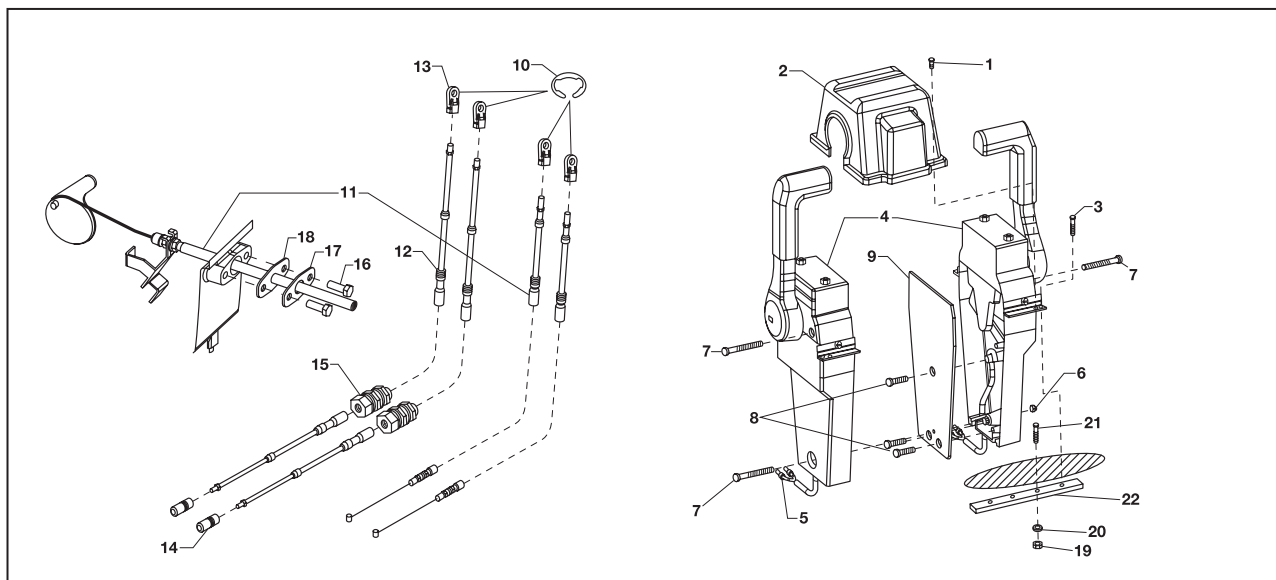


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>STEERING HELM REMOVAL</b>		Follow the "Step" order for removal.
1	Cover	1	
2	Nut	1	1/2"-13, Nylon lock, 18 Nm (1.8 m-k-g, 13 ft-lb)
3	Washer	1	1/2"
4	Steering Wheel	1	
5	Key	1	
6	Boot	1	
7	Screw	2	#8 x 1", 1.8 Nm (0.18 m-k-g, 1.3 ft-lb)
8	Helm, Bezel	1	
9	Screw, socket head	1	3/16"-24 x 1", LT 242
10	Screw	2	
11	Steering Pivot	1	
12	Nut	1	3/8" Nylon lock, 20 Nm (2.0 m-k-g, 14 ft-lb)
13	Washer	1	3/8"
14	Bolt	1	
15	Bearing	1	
16	Bolt, Shoulder	1	1/4"-20, shoulder bolt, 6.4 Nm (0.64 m-k-g, 4.6 ft-lb)
17	Bearing	1	
18	Bolt	3	1/4"-20, 14 Nm (1.4 m-k-g, 10 ft-lb), LT 242
19	Washer	3	
20	Steering Master	1	
21	Nut	3	1/4"-20 Nylon lock, 7 Nm (0.7 m-k-g, 5 ft-lb)
22	Washer	3	1/4" fender
23	Hex Head Bolt	3	1/4"-20
24	Steering Mount	1	
	<b>STEERING CABLE</b>		
①	Nut w/Washer	2	12 Nm (1.2 m-k-g, 8.7 ft-lb), LT 242
②	Block, Pivot Arm	1	
③	Screw	2	3.7 Nm (0.37 m-k-g, 2.7 ft-lb)
④	Connector Sub-Assembly	1	
	Cleanout Tray		Refer to "Jet Pump Clean-Out Ports" in Chapter 6.
⑤	Nut	4	33 Nm (3.3 m-k-g, 24 ft-lb), 1 drop LT 242 on threads
⑥	Washer	4	Seal with Silicone sealer on inside of hull
⑦	Clip	2	3.5 Nm (0.35 m-k-g, 2.5 ft-lb)
⑧	Washer	2	
⑨	Pin	2	
⑩	Bushing, Nylon	4	
⑪	Nut	2	17 Nm (1.7 m-k-g, 12 ft-lb)
⑫	Steering Clevis	2	
⑬	Steering Cables	2	
			Reverse the removal steps for installation.



## REMOTE CONTROL SYSTEM EXPLODED DIAGRAM



### REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Qty	Service Points
	<b>REMOTE CONTROL UNIT REMOVAL</b>		Follow the "Step" order for removal.
1	SCREW	4	M4-0.7 X 10 mm, 2 Nm (0.2 kgf-m, 0.4 ft-lb)
2	COVER	1	
3	SCREW	4	#10-24 X 1" PPH, 4 Nm (0.4 kgf-m, 0.9 ft-lb)
4	REMOCON ASSY	1	Lift from deck for access to wire and cable connections.
5	NEUTRAL SWITCH ASSY	2	
6	NUT	1	M5-0.8 HH, 4 Nm (0.4 kgf-m, 0.9 ft-lb)
7	SCREW	3	M5-0.8 X 55 mm
8	SCREW	3	M5-0.8 X 10 mm
9	BACK PLATE	2	
10	CIRCLIP	4	
11	THROTTLE CABLE	2	Remove air cleaner top to access throttle cable ends.
12	REVERSE CABLE	2	
13	EYELET	4	
14	JOINT, BALL	2	
15	CONNECTOR CABLE	2	
16	BOLT	4	M6-1.5 X 18 mm, 6.4 Nm (0.65 kgf-m, 1.4 ft-lb)
17	PLATE (THROTTLE)	2	
18	PACKING, CABLE	2	
19	NUT, SELF LOCKING	4	#10-24 NYLON LOCK, 2 Nm (0.2 kgf-m, 0.4 ft-lb)
20	WASHER, PLAIN	4	#10 FLAT
21	SCREW	4	#10-24 X 1 1/4" PFH
22	PLATE (SHIFTER)	2	
			Reverse the removal steps for installation.

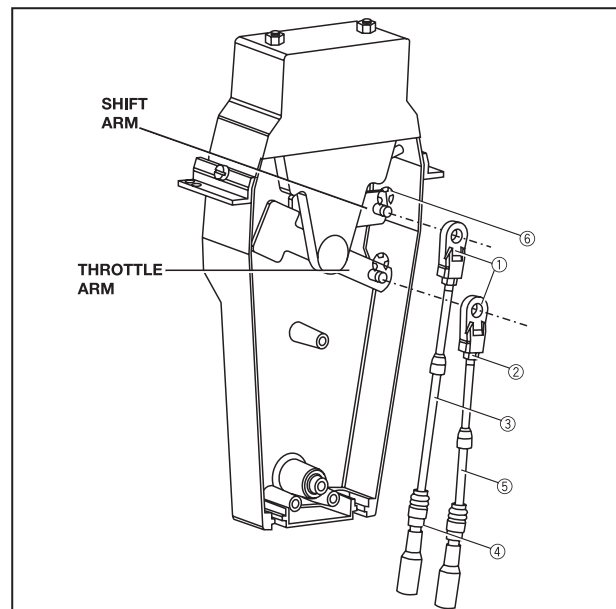


## SERVICE POINTS

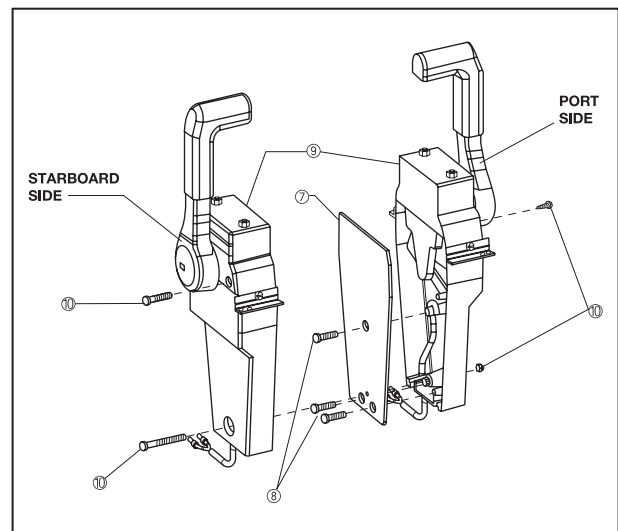
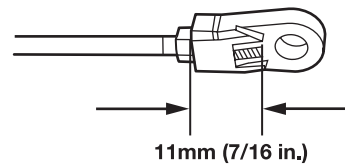
### Throttle/ Shift Cable Installation

#### Install Cables into Remote Control

1. Remove:
  - Four screws holding the remote control unit cover.
  - Four screws holding the remote control unit to the deck.
  - Lift the remote control unit.
  - Disassemble remote control unit.
2. Set:
  - Remote Control levers in Neutral position.
3. Install:
  - Cables joints ① onto each cable so there is 11mm (0.44 in.) of thread engagement on the cable ends - see Detail A.
4. Tighten:
  - Cable Joint lock nuts ②.  
2.9 Nm (0.3 kgf-m, 2.2 ft-lb)
5. Install:
  - Reverse cable ③ onto Shift Arm pin and into the housing clamp so that the groove in the outer cable fits into the ridge in the housing clamp ④.
  - Insert Throttle cable ⑤ in same manner.
  - Secure Cable joints to the Shift and Throttle arm pins with circlip ⑥.
6. Assemble:
  - Backplate ⑦ and screws ⑧.
  - Remote Control assembly ⑨ with screws and bolt/ nut ⑩.  
3.9 Nm (0.4 kgf-m, 2.9 ft-lb)
7. Install:
  - Remote Control Assembly in boat deck.  
4.4 Nm (0.45 kgf-m, 3.3 ft-lb)
8. Install:
  - Remote Control cover.  
1.9 Nm (0.2 kgf-m, 1.4 ft-lb)



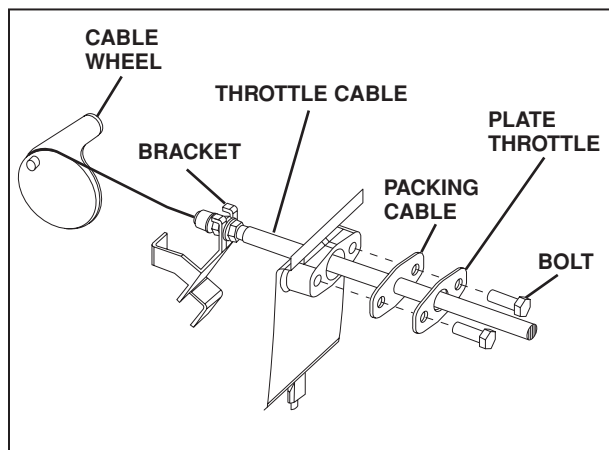
DETAIL A





### Install Throttle Cables

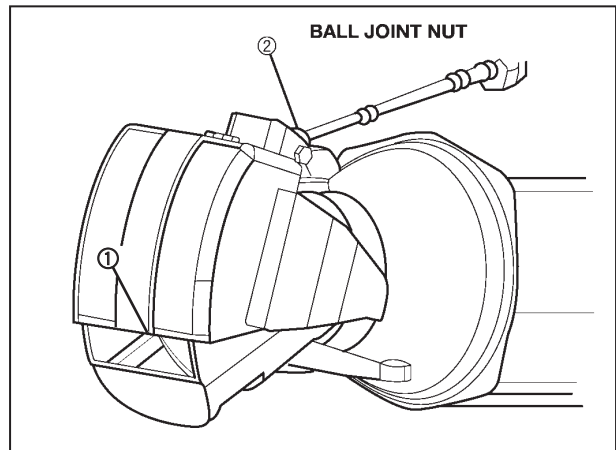
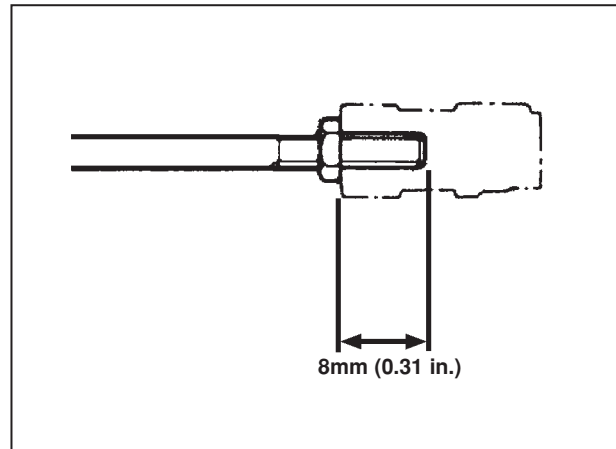
1. Remove:
  - Air box cover.
2. Install:
  - Pass Throttle Cable through the Plate Throttle, Packing Cable and Air box fitting.
  - Throttle cable end into the Cable Wheel on throttle body assembly.
  - Throttle cable adjuster into Bracket.
3. Tighten:
  - Plate, Throttle Bolts:  
6.4 Nm (0.65 kgf-m, 4.7 ft-lb)
4. Adjust:
  - Throttle cable adjustment per the steps in Chapter 3 - Periodic Inspection and Adjustment.





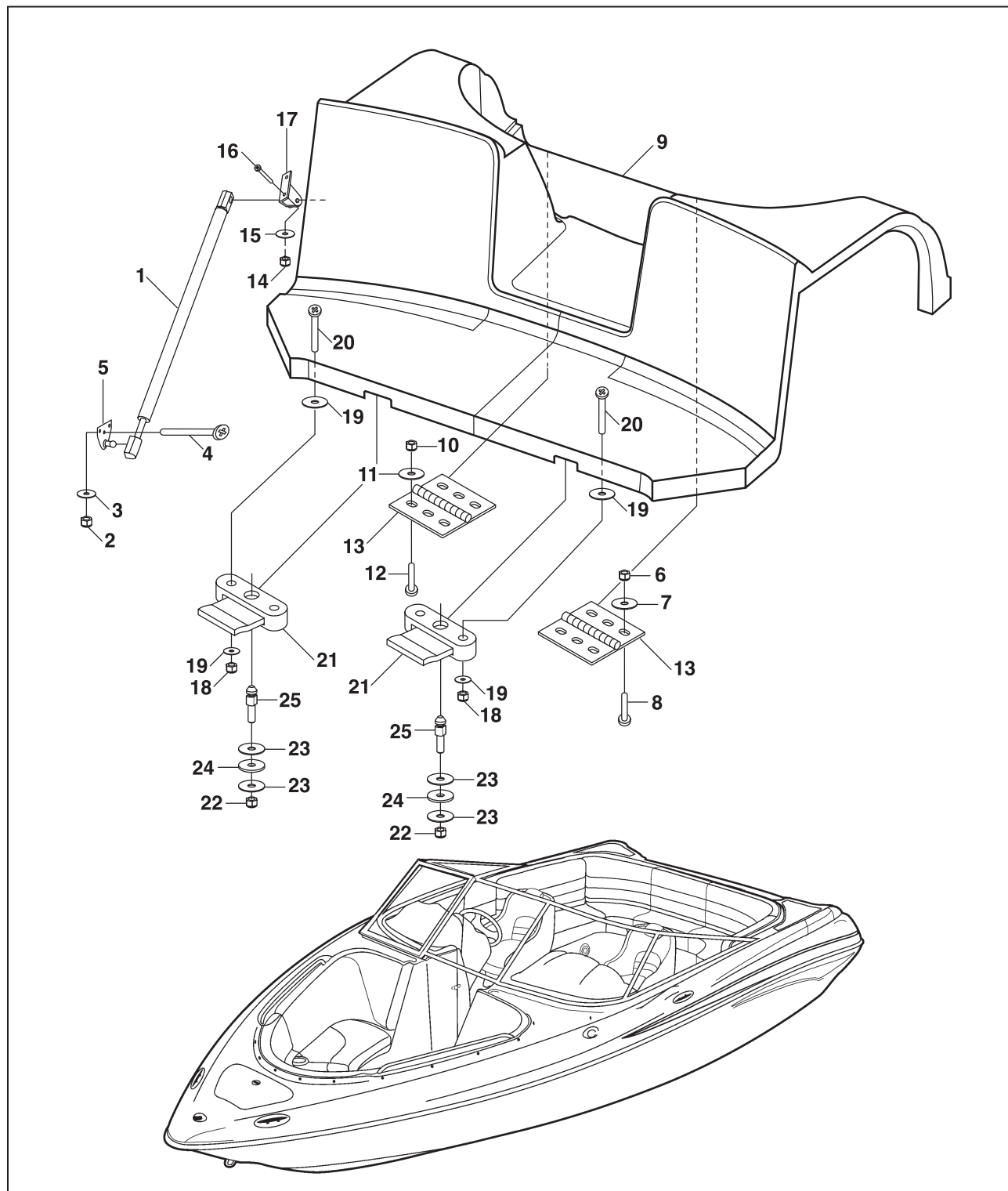
### Install Reverse Cables

1. Install:
  - Ball Joints onto shift cable ends making sure the joint has at least 8mm (0.31 in.) of thread engagement on the shift cable ①.
2. Tighten:
  - Ball Joint lock nut ②.  
2.8 Nm (0.29 kgf-m, 2.1 ft-lb)
3. Adjust:
  - Shift cable per the steps in Chapter 3 - Periodic Inspection and Adjustment.





## ENGINE HATCH EXPLODED DIAGRAM





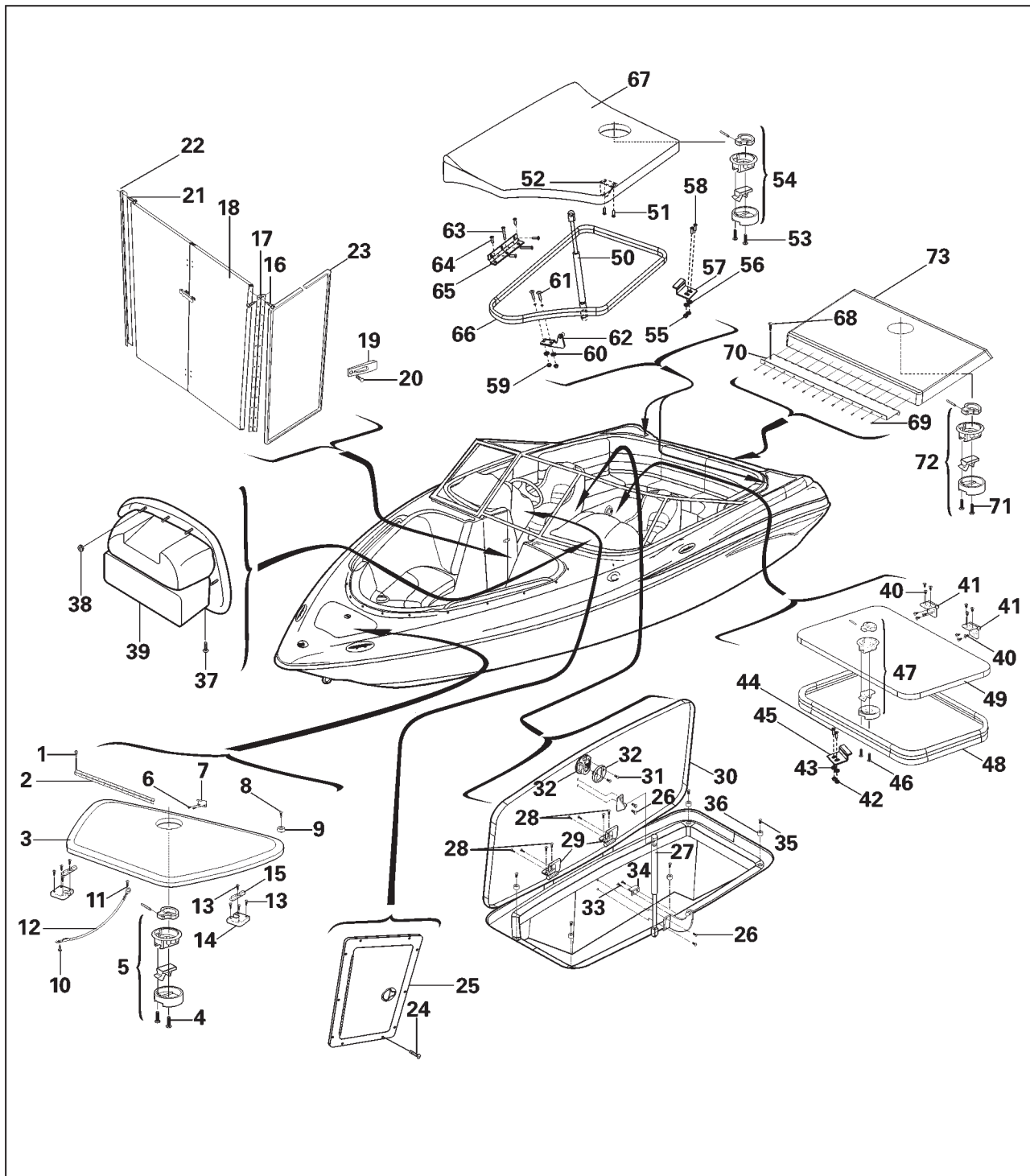


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>ENGINE HATCH REMOVAL AND DISASSEMBLY</b>		Follow the "Step" order for removal.
1	Support, Engine Hatch	2	Support Hatch Lid before removal.
2	Nut, #10-24 Nylon Lock	4	
3	Washer, 310 Fender 3/4" O.D.	4	
4	Screw #10-24 x 1"	4	
5	Bracket, Support	2	
6	Nut, 1/4-20 Nylon Lock	6	
7	Washer, Fender 1/4"	6	
8	Screw 1/4-20 x 1-3/4"	6	
9	Engine Hatch Assembly	1	
10	Nut, 1/4-20 Nylon Lock	6	
11	Washer, Fender 1/4"	6	
12	Screw 1/4-20 x 1-3/4"	6	
13	Hinge, Engine Hatch	2	
14	Nut, #10-24 Nylon Lock	6	
15	Washer, #10 Fender 3/4" O.D.	6	
16	Screw, #10-20 x 2.5"	6	
17	Base, hatch Support	2	
18	Nut, 1/4-20 Nylon Lock	4	
19	Washer, 1/4"	4	
20	Screw, 1/4-20 x 1-3/4"	4	
21	Seat Lock Assembly	2	
22	Nut, #10-24 Nylon Lock	2	
23	Washer, 7/16" Fender 1-1/2" O.D.	4	
24	Washer, Special Cotton	2	
25	Pin	2	
			Reverse the removal steps for installation.



## HATCH FITTINGS/BOW COVER EXPLODED DIAGRAM



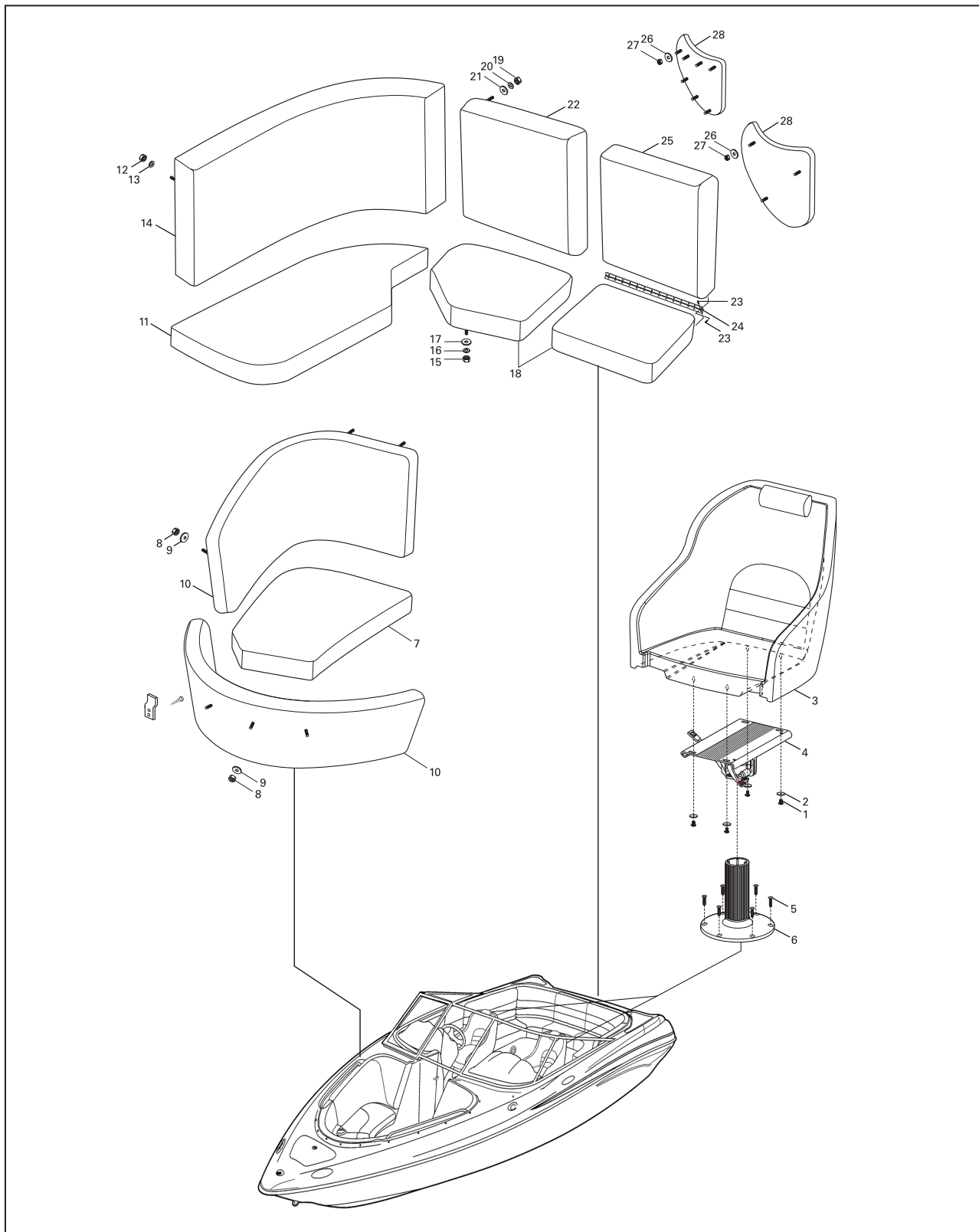


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points	Step	Procedure / Part Name	Q'ty	Service Points
	<b>BOW LOCKER DISASSEMBLY</b>		Follow the "Step" order for removal.		<b>GLOVEBOX HATCH</b>		
1	Screw, Tapping	16	#8 x 5/8"	37	Screw	3	#10 X 3/4"
2	Hinge	1		38	Nut	3	10-24
3	Hatch	1		39	Glovebox Hatch Assem.	1	
4	Screw, Machine	2			<b>FUEL HATCH</b>		
5	Latch	1		40	Screw	12	#8 x 3/8"
6	Screw, Tapping	2		41	Hinge, Fuel Hatch	2	
7	Catch	1		42	Nut, Nylon Lock	2	#10-24
8	Screw	2	#8 x 3/4"	43	Washer, Flat	2	#10
9	Cushion	2		44	Screw	2	10-24 x 1-1/4"
10	Screw	1	#10 x 1/2"	45	Catch	1	
11	Screw	1	#8 x 3/4"	46	Screw, Machine	2	
12	Hatch Support	1	Twist one turn when re-attaching	47	Latch	2	
13	Screw	6		48	Seal, Fuel Hatch	1	
14	Anchor Retainer Bracket	2		49	Hatch, Fuel Hatch	1	
15	Anchor Retainer	2			<b>STERN LOCKER HATCHES</b>		
	<b>BI-FOLD DOOR</b>			50	Support, Locker hatch	2	
16	Screw	28	#6 X 3/4"	51	Screw	4	#10 x 1/2"
17	Hinge	1		52	Bracket	2	
18	Bi-Fold Door Assembly	1		53	Screw, Machine	4	
19	Screw	4	#8 x 5/8"	54	Lock Assembly	2	
20	Catch	3		55	Nut, Nylon Lock	4	#10-24
21	Screw	5	#8 x 3/4"	56	Washer, Flat	4	#10 7/16" O.D.
22	U-Channel	1		57	Catch	2	
23	Edge Guard 1/2" x 3/8"	1	Re-install with hot melt adhesive	58	Screw	2	#10-24x1.0"
	<b>STARBOARD CONSOLE DOOR</b>			59	Nut, Nylon Lock	2	1/4-20
24	Screw	10	#8 X 5/8"	60	Washer, Flat	2	1/4-Flat
25	Door Assembly, Console	1		61	Screw	2	1/4-20x1"
	<b>SKI LOCKER HATCH</b>			62	Bracket	5	
26	Screw	6		63	Screw, #10-24 x 1.5"	1	Starboard only
27	Support, Ski Hatch	1		64	Screw	6	#10 x 3/4"
28	Screw	12	#8 x 3/4"	65	Hinge, Stern Locker Hatch	2	
29	Hinge	2		66	Packing, 4	2	
30	Hatch Assem., Ski Hatch	1			<b>CLEANOUT HATCH</b>		
31	Screw, Machine	2		67	Hatch	1	
32	Latch	1		68	Screw	14	#10 x 1/2"
33	Screw	2	#8 x 5/8"	69	Screw	12	#10 x 3/4"
34	Catch	1		70	Hinge, Cleanout Hatch	1	
35	Screw	5	#8 x 3/4"	71	Machine Screw	2	
36	Cushion	5		72	Lock Assembly	1	
				73	Hatch, Cleanout	1	
							Reverse the removal steps for installation.



## SEAT FITTINGS EXPLODED DIAGRAM



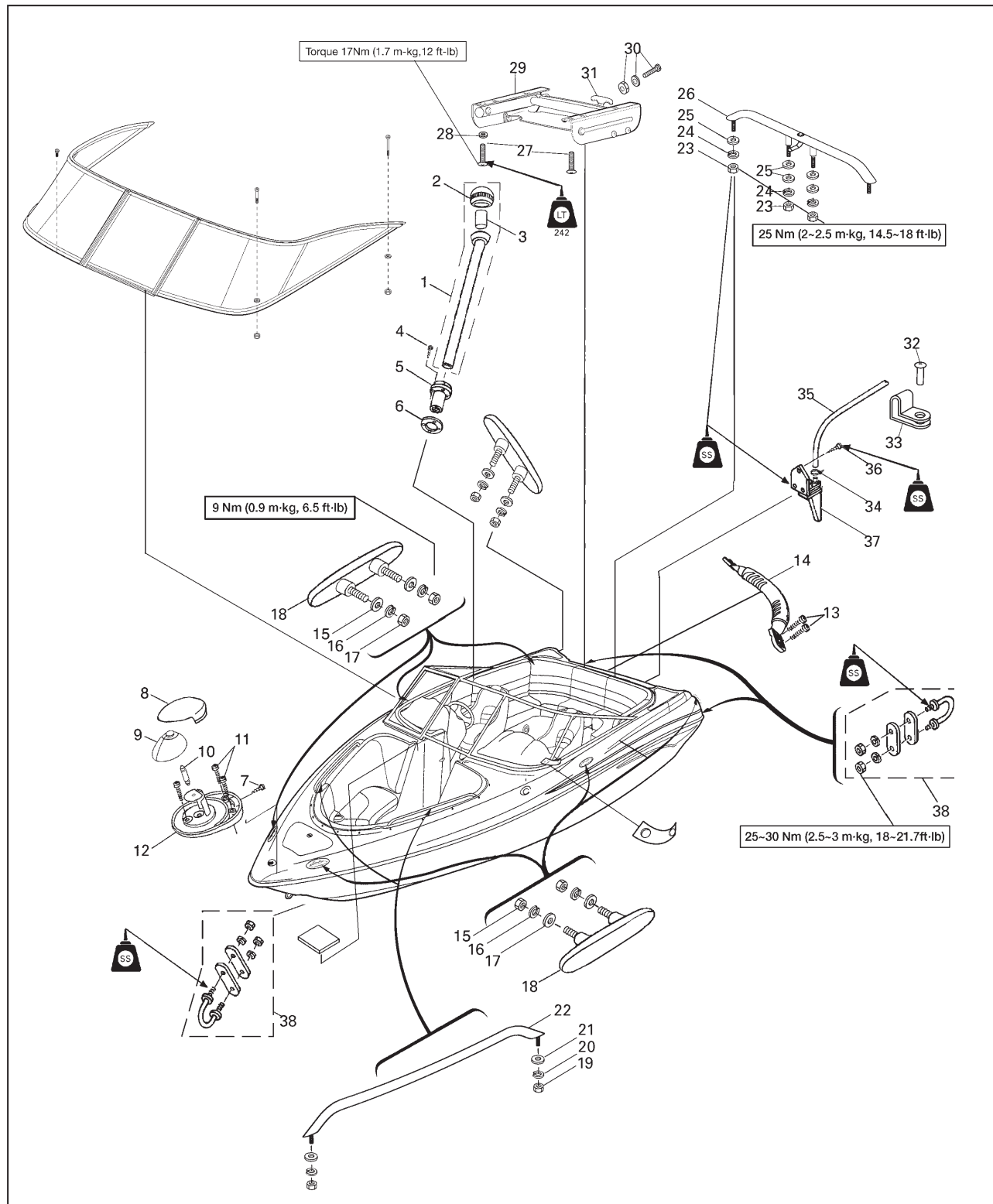


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>SEAT FITTING DISASSEMBLY</b>		Follow the "Step" order for removal.
	<b>DRIVER'S BUCKET SEATS</b>		
1	Screw, 1/4-20 x 1/2"	8	
2	Washer, Flat 1/4 x 1" Fender	8	
3	Driver Seat Assembly	2	
4	Seat Slider	2	
5	Screw, 1/4-20 x 1 1/4"	12	
6	Pedestal Base	2	
	<b>BOW SEATS</b>		
7	Seat Cushions	3	
8	Nut 1/4-20	24	Access nuts through under seat storage
9	Washer, Flat 1/4 x 1 1/2" Fender	24	
10	Bow Seat Backrests	3	Lift backrests off mounting clips
	<b>MIDSHIP SEATING</b>		
11	Seat Cushions	2	
12	Nut 1/4-20	4	Access nuts through under seat storage
13	Washer, Flat 1/4 x 1 1/2" Fender	4	
14	Seat Backrests	2	Lift backrests off mounting clips
	<b>ENGINE HATCH SEATS</b>		
15	Nut 1/4-20	4	Open engine hatch
16	Lock Washer 1/4-20	4	
17	Washer, Flat 1/4 x 1 1/2" Fender	4	
18	Seat Cushions	3	
19	Nut 1/4-20	4	
20	Lock Washer 1/4-20	4	
21	Washer, Flat 1/4 x 1 1/2" Fender	4	
22	Backrest	2	
23	Screw, Tapping	8	
24	Hinge	1	
25	Folding Backrest	1	
	<b>SWIM PLATFORM PADS</b>		
26	Nut 1/4-20	18	Access nuts through stern port and
27	Washer, Flat 1/4 x 1 1/2" Fender	18	starboard hatch inspection covers
28	Backrest Pads	4	
			Reverse the removal steps for installation.



## DECK FITTINGS EXPLODED DIAGRAM





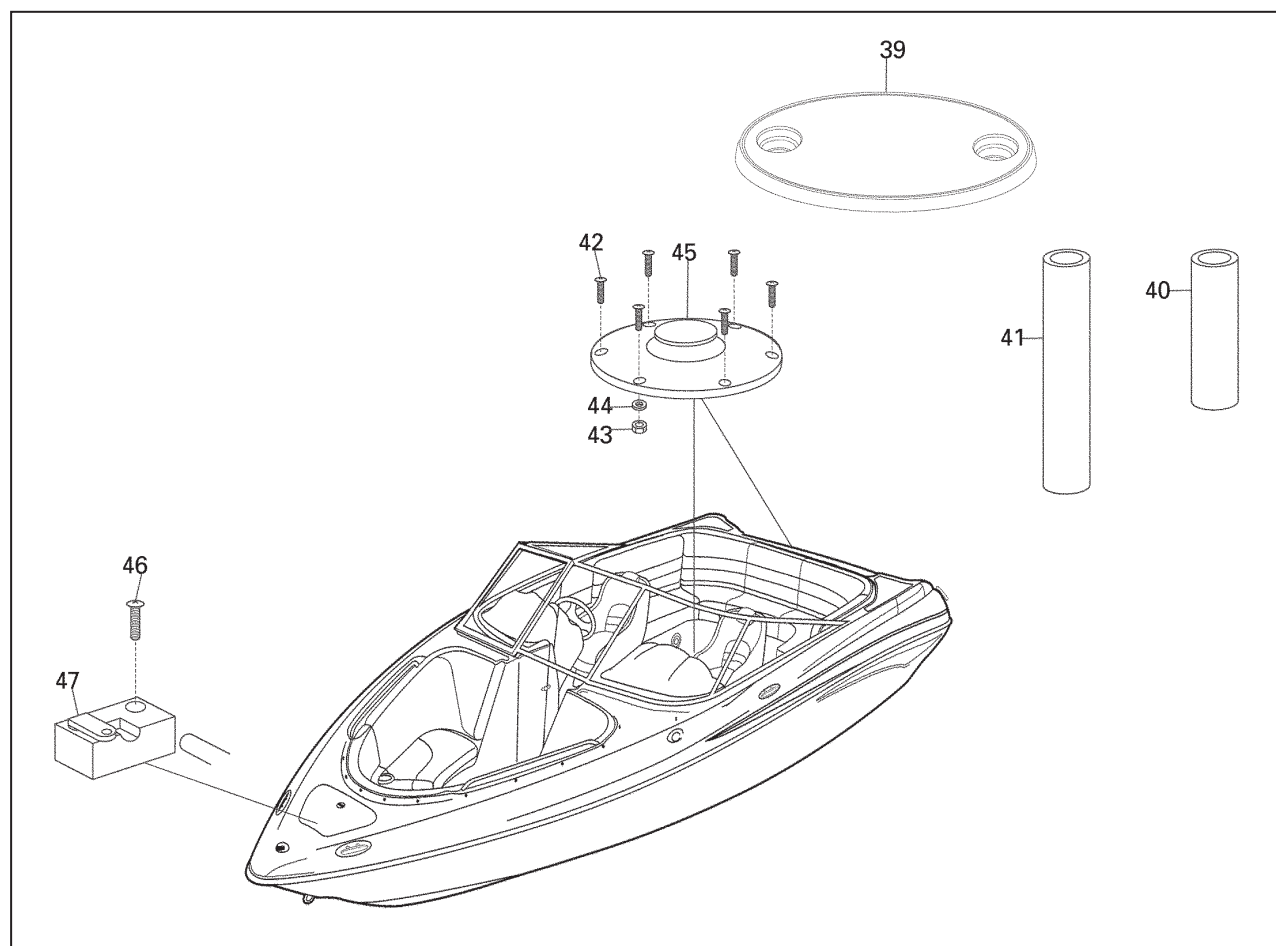
## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>STERN LIGHT</b>		Follow the "Step" order for removal.
1	Stern Light Assembly	1	
2	Lens	1	
3	Bulb	1	ML1004 obtain locally
4	Screw, Tapping	3	
5	Socket Assembly	1	
6	Collar (Shim)	1	Position so that Stern Light angles towards stern.
	<b>BOW LIGHT</b>		
7	Screw, Tapping	1	
8	Cover	1	
9	Lens	1	
10	Bulb	1	Festoon 12V 8W, obtain locally
11	Screw	3	
12	Socket Assembly	1	
	<b>DECK FITTINGS</b>		
13	Screw, #8 X 3/4"	4	
14	Handle, Grip	1	Apply silicone sealer to mounting holes
15	Nut, 5/16-18	12	LT242, Torque 13 Nm (1.35m-kg. 9.5ft-lb)
16	Washer, Lock 5/16"	12	
17	Washer, Flat 5/16"	12	
18	Cleat	6	Silicone sealer in cleat mount holes.
19	Nut, 5/16-18	4	LT242, Torque 13Nm (1.35m-kg, 9.5 ft-lb)
20	Washer, Lock 5/16"	4	
21	Washer, Flat 5/16"	4	
22	Rail, Hand (Bow)	2	
23	Nut, 5/16-18	4	LT242, Torque 13Nm (1.35m-kg, 9.5ft-lb)
24	Washer, Lock 5/16"	4	
25	Washer, Flat 5/16"	6	Washers are placed on center 2 studs of the Grip Ass'y, Ski Tow before installing on hull. The remaining 4 washers are placed on all 4 studs after inserting thru holes in hull.
26	Grip Assembly, Ski Tow	1	Silicone sealer around base of studs.
27	Bolt, M8 x 35mm HH	4	LT242, Torque 17Nm (1.7 m-kg, 12 ft-lb)
28	Washer, M8 Flat	4	
29	Ladder, Transom	1	
30	Screw (w/ nut & washer)	1	Attaches Band to Ladder
31	Band	1	
32	Screw, #8 x 5/8" PPH	1	
33	Clamp	1	
34	Clamp, Cable (Tiewrap, 6")	1	
35	Tube (Speedometer)	1	
36	Screw, #8 X 3/4" PPH	3	
37	Speedometer Sensor	1	Silicone sealer on back side of speedo sensor and in the 3 mounting holes in hull
38	Bow and Stern Eyes (w/ nuts and plates)	3	Torque 15Nm (1.5m-kg, 11 ft-lb) Apply silicone sealer to mounting surfaces.



## DECK FITTINGS (Continued)

### EXPLODED DIAGRAM

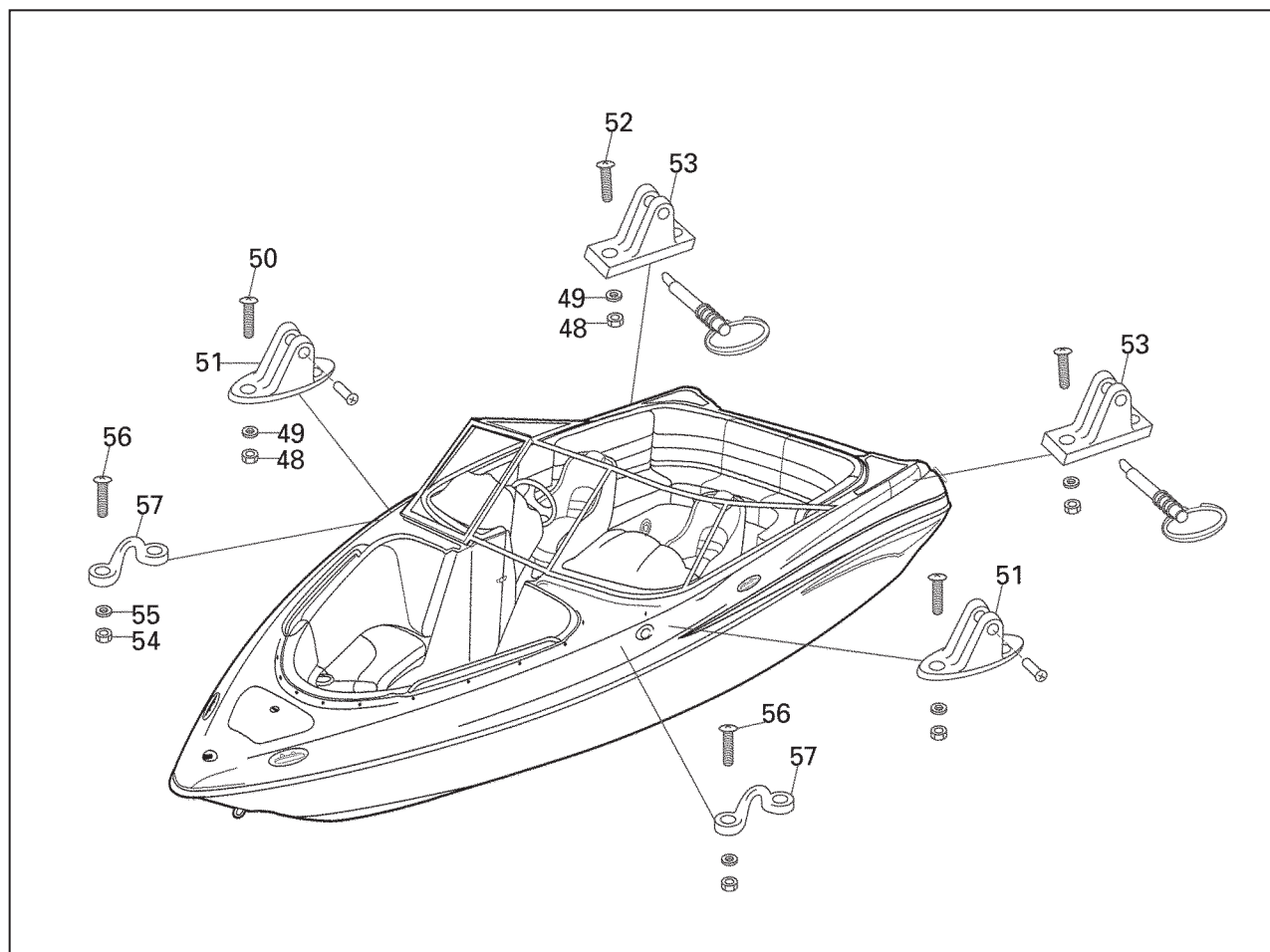


Step	Procedure / Part Name	Q'ty	Service Points
	<b>TABLE</b>		
39	Table	1	
40	Stanchion (Table Post) Short, Swim Deck	1	330mm, 13 in
41	Stanchion (Table Post) Long, Cockpit	1	622mm, 24.5 in
42	Screw 1/4-20 x 1-3/4" POH	12	
43	Nut, 1/4-20 Nylon Lock	12	Torque 8Nm (0.8m-kg, 6 ft-lb)
44	Washer, 1/4" x 1" OD Fender	12	
45	Table Mount	2	Silicon sealer around bolt holes and mount opening in deck.
	<b>ANCHOR ROPE RETAINER</b>		
46	Screw, #10 X 1-1/2" POH	6	
47	Bracket	2	





## REMOVAL AND INSTALLATION CHART (Continued)

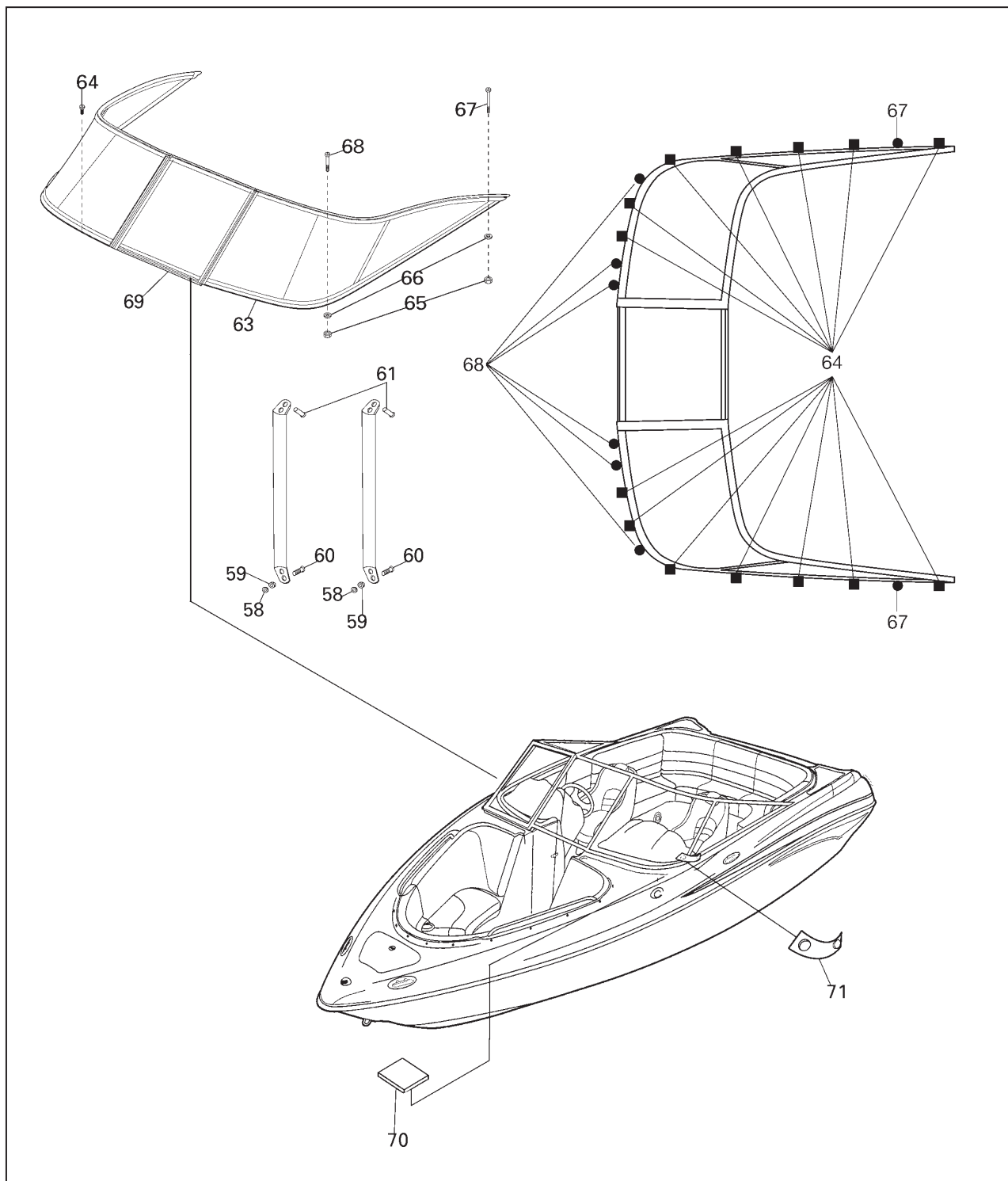


Step	Procedure / Part Name	Q'ty	Service Points
	<b>BIMINI TOP BRACKETS</b>		
48	Nut, 10-24 Nylon Lock	8	Torque 4Nm (0.4m-kg, 3 ft-lb)
49	Washer, 10 x 3/4" OD	8	
50	Screw, 10-24 x 1-1/2" POH	4	
51	Bracket, Awning (front)	2	Torque 3Nm (0.3m-kg, 2 ft-lb)
52	Screw, 10-24 x 1" POH	4	
53	Bracket, Awning 2 (rear)	2	
54	Nut, #8-32 Nylon Lock	4	
55	Washer, #10 x 3/4" OD	4	
56	Screw, #8-32 x 1" POH	4	
57	Eye, Strap	2	



## DECK FITTINGS (Continued)

### EXPLODED DIAGRAM

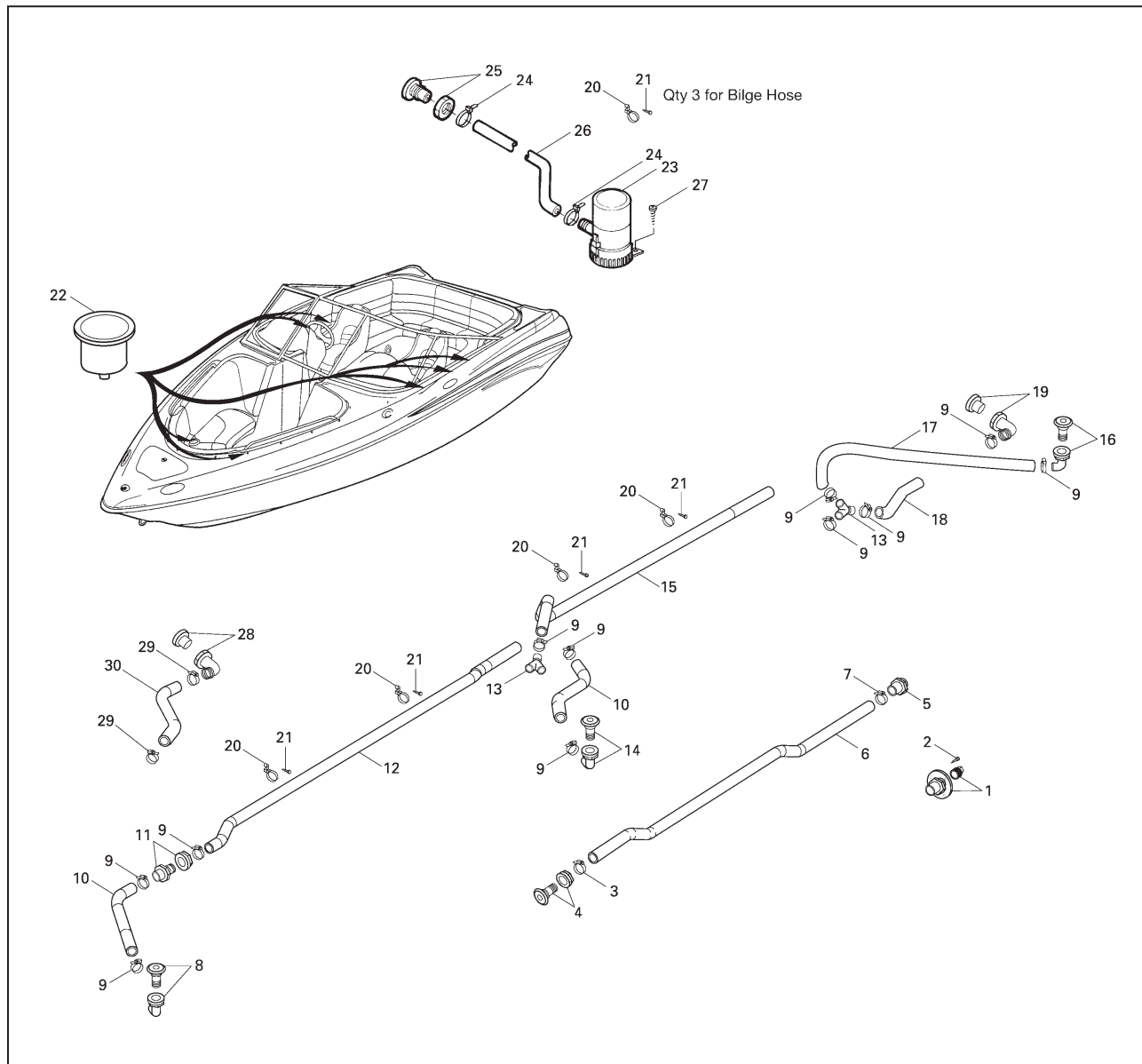


REMOVAL AND INSTALLATION CHART *(Continued)*

Step	Procedure / Part Name	Q'ty	Service Points
	<b>WINDSHIELD</b>		
58	Nut, 10-24 Nylon Lock	4	Torque 4Nm (0.4m-kg, 3 ft-lb)
59	Washer, #10 Flat	4	
60	Screw, 10-24 x 2" PPH	4	
61	Screw, #8 x 3/8" PPH-Type B	4	
62	Windshield Brace	2	Remove to access screws
63	Windshield Trim		
64	Screw, #8 x 3/4" POH	14	
65	Nut, 8-32 Nylon Lock	8	Torque 3Nm (0.3m-kg, 2 ft-lb)
66	Washer, #8 Flat	8	
67	Screw, 8-32 x 2" POH	2	
68	Screw, 8-32 x 1-1/2 POH	6	
69	Windshield Assembly	1	
70	Pad, Windshield	1	
71	Windshield Tie-down	1	



## THROUGH HULL AND DRAIN FITTINGS EXPLODED DIAGRAM



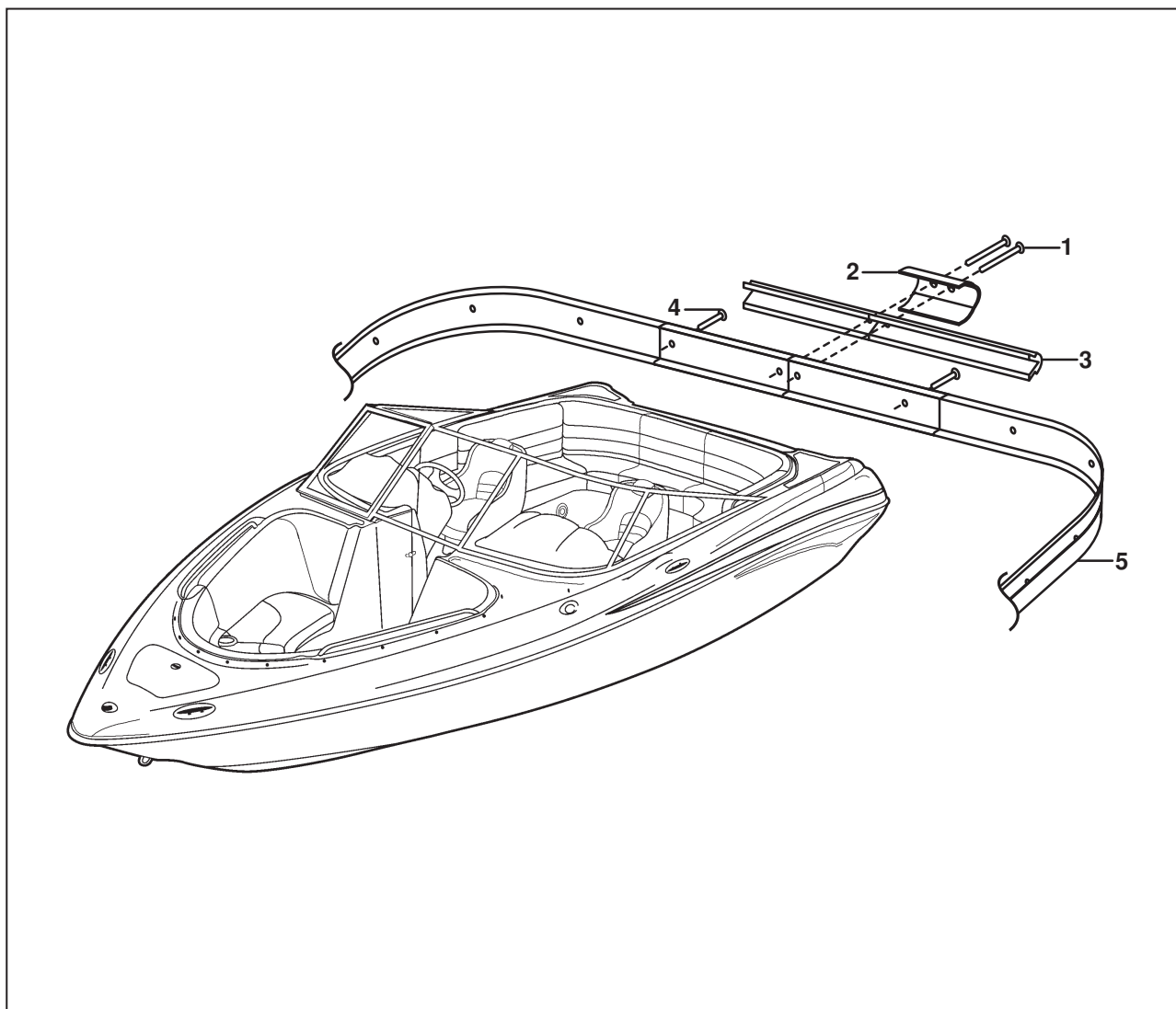


## REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>THROUGH HULL AND DRAIN FITTINGS</b>		Follow the "Step" order for removal.
1	Drain Plug	1	Apply silicone to the drain plug assy flange.
2	Screw #8 x 3/4 POH	3	
3	Clamp, Hose 2 (SAE #24)	1	
4	Cockpit Drain	1	
5	Scupper Drain for Cockpit	1	Apply clear silicone to the base.
6	Pipe, Bilge (Hose, 1 1/2" X 72")	1	
7	Clamp, Hose 2 (SAE #24)	1	
8	Ski Hatch Drain	1	Apply clear silicone to the base.
9	5/16" Worm Gear Clamp	12	
10	Hose, Drain	2	
11	Thru Hull Fitting	1	Apply clear silicone to the base.
12	Hose, Drain	1	
13	Joint Drain - Y Fitting	1	
14	Fuel Tank Compartment Drain	1	Apply clear silicone to the base.
15	Hose, Drain	1	
16	Cleanout Tray Drain	1	Apply clear silicone to the base.
17	Hose, Drain	1	
18	Hose, Drain	1	
19	Drain Outlet	1	Apply clear silicone to the base.
20	Clamp, Cable (Tiewrap 8")	8	
21	Screw, #8 x 5/8" PPH	8	
22	Drink Holder	7	
23	Bilge Pump	1	
24	5/16" Worm Gear Clamp	2	
25	Bilge Outlet	1	Apply clear silicone to the base.
26	Hose, 1 (3/4" x 48" Bilge Hose)	1	
27	Screw, #10 x 1/2 PPH	2	
28	3/4" Through Hull (90°)	2	Apply clear silicone to the base.
29	5/16" Worm Gear Clamp	2	
30	Hose, Drain, 23.75"	1	Ice box drain.



## GUNWALE EXPLODED DIAGRAM



### REMOVAL AND INSTALLATION CHART

Step	Procedure / Part Name	Q'ty	Service Points
	<b>GUNWALE</b>		Follow the "Step" order for removal.
1	Screw, 310 x 2" POH	2	Torque 2 Nm (0.2m-kg, 1.5 ft-lb)
2	Cover, rub Rail Joint	1	Before installing, apply silicone to the join area.
3	Inner Gunwale (Rubrail insert)	1 pc	Heat in warm water for installation and gunwale indent area with a hair dryer or low temperature heat gun.
4	Screw, #10 x 1-1/4" PFH	210	Torque 2 Nm (0.2m-kg, 1.5 ft-lb)
5	Gunwale (Rubrail)	1 pc	Fill in any gaps above or below the gunwale with white silicone.
			Reverse the removal steps for installation.



## HULL CONSTRUCTION AND CARE

The SRT1100 hull is built of a material called FRP. This is then finished with a very hard product called gelcoat to protect the fiberglass and provide a durable finish.

### WHAT IS FRP?

FRP stands for *Fiberglass Reinforced Plastic*. It is a composite material in which a fiberglass reinforcement material such as chopped strand mat (mat) and/or a woven fabric (cloth) is impregnated with a catalyzed polyester resin and allowed to cure into a rigid state. Also, included in this definition are fabrics impregnated with epoxy resins and hardeners.

### CHARACTERISTICS OF FRP

FRP has the following characteristics:

1. High strength yet light-weight
2. Excellent malleability
3. Corrosion free
4. Easy to care for and easy to repair. On the other hand, it is liable to get scratched and is vulnerable to shocks and, therefore, must be handled with care.

**NOTE:** Should any of the FRP or Gelcoat require repair, refer to the *Basic Hull Repair Video and Workbook* (VID-10660-00-43).

### MAINTENANCE OF FRP

Routine care is important for FRP as it helps in maintaining the high luster. During maintenance, any damage to the FRP can be detected early so repairs can be easily accomplished ensuring long service life.

After use, wash down the hull with fresh water. Wax the hull with a non-abrasive wax such as Yamaha Ultra-gloss Cleaner Wax or other wax designed for marine gelcoat.

Take the following additional steps when necessary:

#### 1. Maintenance of luster

The gelcoat layer is 0.3 to 0.5mm (0.12 to 0.20 in) thick. When it has faded or has lost its luster, the original luster can be restored by polishing to remove the oxidized layer.

Polishing procedures:

- a. Clean the gelcoat surface with water and neutral detergent.
- b. Polish with a fine rubbing compound. If no polisher is available, polish with a rag and compound.
- c. After polishing, apply several coats of a good marine wax, allowing each coat to dry prior to buffing and applying the next coat.

#### 2. Fading and discoloration

How to clean:

- a. Fading may require the use of a heavy duty rubbing compound and subsequent polishing to restore the original gelcoat luster. If this does not work, see item "d" below.
- b. Discoloration due to oil stains, fuel stains, or environmental factors may be removed with detergents or industrial solvents if needed. A rag or sponge moistened with acetone may also help. However, avoid excessive exposure of gelcoat to acetone as the surface may become permanently damaged.
- c. Marine growth can be scraped off using sharpened wooden sticks. Avoid metal putty knives, etc. as they will tend to scratch the gelcoat.
- d. If all else fails, use a wet/dry sandpaper to color sand the gelcoat down to consistent color. Use extreme care as too much sanding will remove all the gelcoat and new gelcoat will have to be applied. Start with #600 grit and end with #1200 to #1500 grit with lots of water. For best results, final sanding should always be in the same directions (e.g., back and forth). Follow with polishing procedures given above.
- e. If none of the above helps, it is time to re-gelcoat.

## CHAPTER 9

### TROUBLE ANALYSIS

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## INTRODUCTION

### FEATURES

The newly developed Yamaha Diagnostic System provides quicker detection and analysis of engine malfunctions for quicker troubleshooting procedures than traditional methods.

By connecting your computer to the ECM (Electronic Control Module) of a watercraft using the communication cable, this software can be used to display sensor data and data stored in the ECM on a computer's monitor.

If this software is run on Microsoft Windows® 95, Windows® 98, Windows® Me, Windows® 2000, or Windows® XP, the information can be displayed in colorful graphics. Also, the software can be operated using either a mouse or a keyboard.

In addition, the data for the main functions (Diagnosis, Diagnosis record, Engine monitor, and Data logger) can be saved on a disk or printed out.

### Functions

1. **Diagnosis:** Each sensor's status and each ECM diagnosis code or item are displayed. This enables you to find malfunctioning parts and controls quickly.
2. **Diagnosis record:** Sensors that had been activated and ECM diagnostic codes that have been recorded are displayed. This allows you to check the watercraft's record of malfunctions.
3. **Engine monitor:** Each sensor's status and the ECM data are displayed. This enables you to find malfunctioning parts quickly.
4. **Stationary test:** With the engine off, ignition, fuel injection, and the electric fuel pump are checked. These tests can be performed quickly.
5. **Active test:** With the engine running, each firing cylinder drops and the engine speed is checked for changes to determine if the cylinder is malfunctioning. These tests can be performed quickly.
6. **Data logger:** From the data stored in the ECM, at least two items of 78 seconds of recorded data are displayed on a graph. In addition, the operating time as compared to the engine speed and the total operating time are displayed. This allows you to check the operating status of the engine.
7. **ECM No.:** The ECM part number is displayed.

### CONTENTS

1. Software (1)
2. Adapter (1)
3. Communication cable (1)
4. Instruction Manual (1)
5. Installation Manual (1)  
(with CD-ROM)

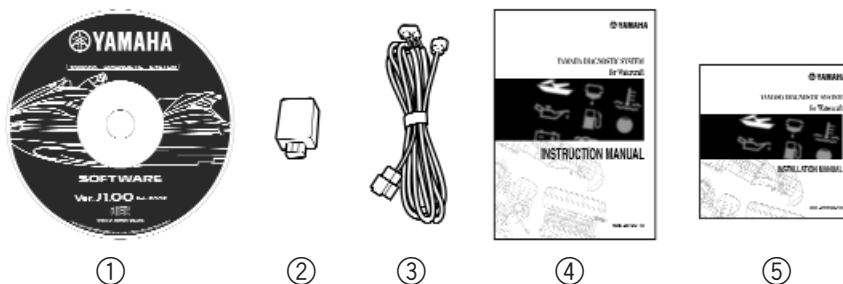


Fig. 1

**HARDWARE REQUIREMENTS**

Make sure your computer meets the following requirements before using this software.

Computer:	IBM-compatible computer
Operating system:	Microsoft Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP (English version)
CPU:	
Windows 95/98:	i486X, 100 MHz or higher (Pentium 100 MHz or higher recommended)
Windows Me/2000:	Pentium, 166 MHz or higher (Pentium 233 MHz or higher recommended)
Windows XP:	Pentium, 300 MHz or higher (Pentium 500 MHz or higher recommended)
Memory:	
Windows 95/98:	16 MB or more (32 MB or more recommended)
Windows Me:	32 MB or more (64 MB or more recommended)
Windows 2000:	64 MB or more (128 MB or more recommended)
Windows XP:	128 MB or more (256 MB or more recommended)
Hard disk free space:	20 MB or more (40 MB or more recommended)
Drive:	CD-ROM drive
Display:	VGA (640 × 480 pixels), (SVGA [800 × 600 pixels] or more recommended) 256 or more colors
Mouse:	Compatible with the operating systems mentioned above
Communication port	RS232C (Dsub-9 pin) port, USB port
Printer:	Compatible with the operating systems mentioned above

**NOTE:**

- The amount of memory and the amount of free space on the hard disk differs depending on the computer.
  - Using this software while there is not enough free space on the hard disk could cause errors and result in insufficient memory.
  - This software will not run properly on some computers.
  - The USB adapter cannot be used with Windows 95.
  - When starting up this program, do not start other software applications.
  - Do not use the screen saver function or the energy saving feature when using this program.
  - If the ECM is changed, restart the program.
  - Window XP is a multiuser operating system, therefore, be sure to end this program if the login user is changed.
-

## GETTING STARTED

This section provides information on installing the Yamaha Diagnostic System under Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.

## INSTALLING THE YAMAHA DIAGNOSTIC SYSTEM UNDER WINDOWS 95, WINDOWS 98, WINDOWS ME, WINDOWS 2000, OR WINDOWS XP

**NOTE:**

- Before installing the Yamaha Diagnostic System, check that your computer meets the specified requirements. For detailed information on the system requirements, see page 9-2.
- It is strongly recommended that you exit all other programs before running the installer.

1. Turn on your computer and start up Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.
2. Insert the compact disc into the computer's CD-ROM drive.
3. Double-click the **My Computer** icon, then the **CD-ROM drive** icon, and then double-click the **Setup.exe** icon to start up the installer. (Fig. 2)

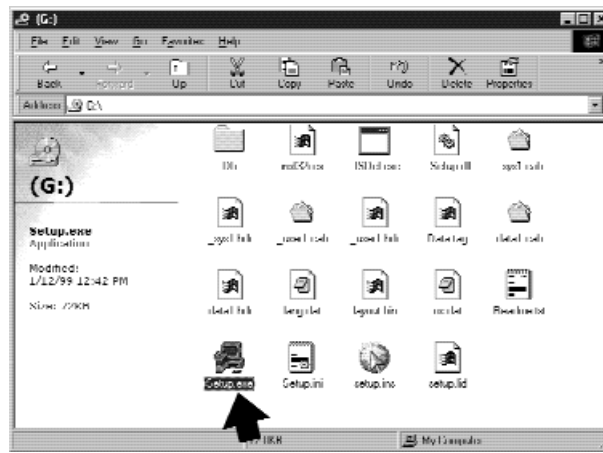


Fig. 2

4. Click the **Next** button to start the installation process. (Fig. 3)

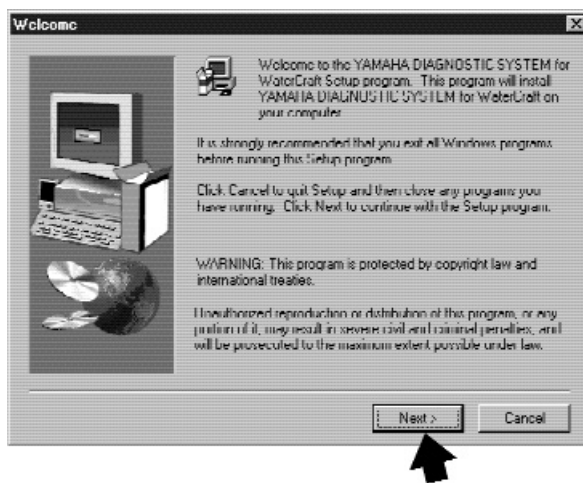


Fig. 3

**NOTE:**

If the Yamaha Diagnostic System has already been installed onto your computer, the following dialog box appears.

Click the **Yes** button to update this program, or click the **No** button to quit the installation. (Fig. 4)

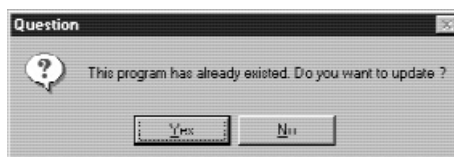


Fig. 4

**NOTE:**

- To quit the installation, click the **Cancel** button. The following dialog box appears.

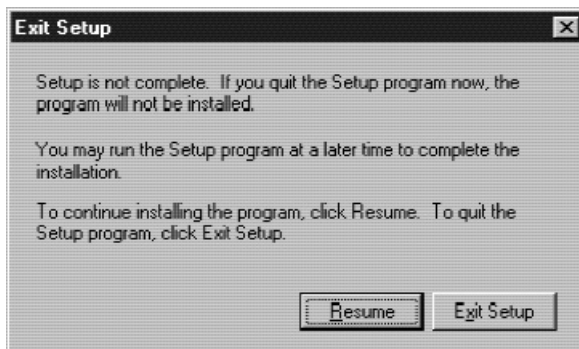


Fig. 5

- To quit the installation program, click the **Exit Setup** button.
  - To resume the installation, click the **Resume** button. (Fig. 5)
-

5. Check the target directory and the program name for the Yamaha Diagnostic System which are displayed in the dialog box.

Click the **Next** button to start copying the program files.

**NOTE:**

- To go back to the previous dialog box (step 4), click the **Back** button.
- To quit the installation, click the **Cancel** button.



Fig. 6

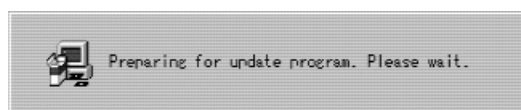
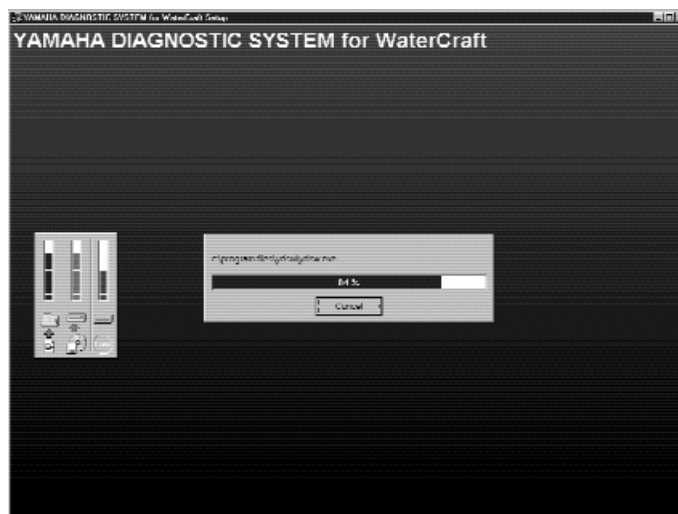


Fig. 7



6. After the installation is completed, the following dialog box appears.  
Click the **Finish** button to quit the installation program.



Fig. 9

**NOTE:**

Install the Database file before using the Yamaha Diagnostic System, otherwise, the program will not operate correctly. For installation procedures, refer to "UPDATING THE DATABASE" on the next page.

---

## UPDATING THE DATABASE

**NOTE:**

When installing the Yamaha Diagnostic System for the first time, be sure to update the database.

1. Turn on your computer and start up Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.
2. From the taskbar at the bottom of your computer screen, click the **Start** button (fig. 10), point to **Programs**, and then click **YAMAHA DIAGNOSTIC SYSTEM for WaterCraft** to open the Yamaha Diagnostic System window. (Fig. 11)

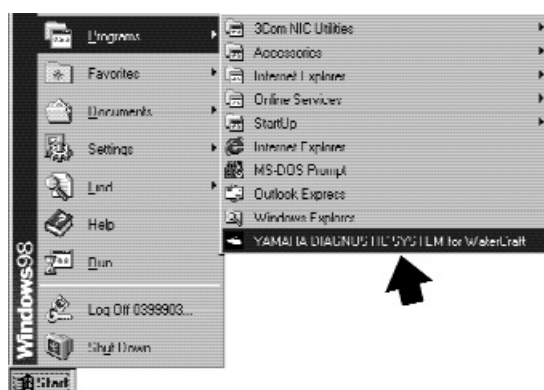


Fig. 10

3. After about three seconds, the display will automatically go to the first menu display, or you can click or press any key to go to the first menu. (See fig. 12.)





4. Click the **Update database [F1]** button or press the F1 key on your keyboard. (Fig. 12)

①

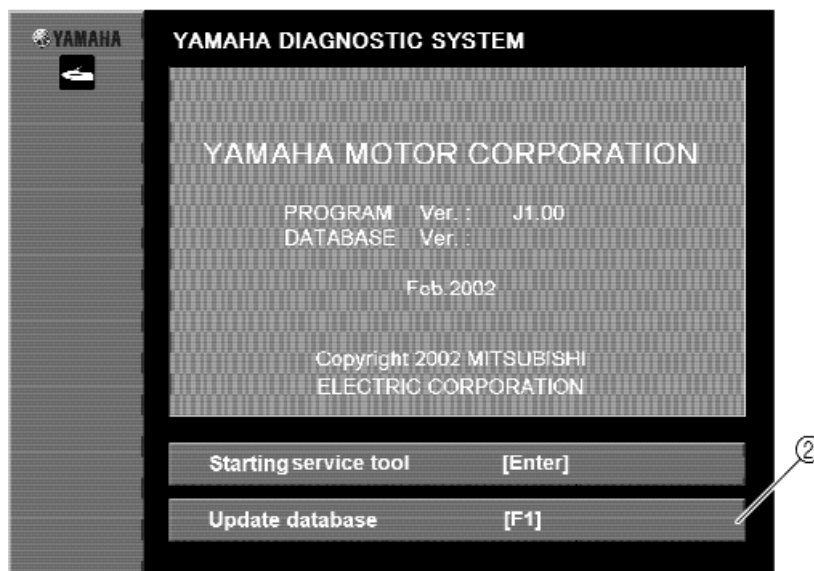


Fig. 12

① First menu

② Click to update database

**NOTE:**

- Do not click the **Starting service tool [Enter]** button or press the Enter key on your keyboard until the database has been updated, otherwise, the program will not operate correctly.
  - To quit the update of the database, press the ESC key on your keyboard.
-

5. Insert the compact disc into the computer's CD-ROM drive.

**NOTE:**

- All the database files will be copied from the compact disc to the computer's hard drive automatically.
- Any earlier version of the database saved on the hard drive will be overwritten.

6. Click the **OK** button or press the Enter key on your keyboard to start copying the database files. (Fig. 13)

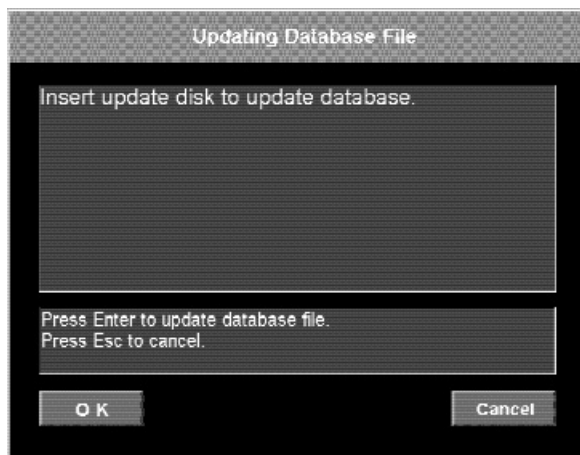


Fig. 13

**NOTE:**

If an error message appears and the program stops operating, follow the error message. (Fig. 14)

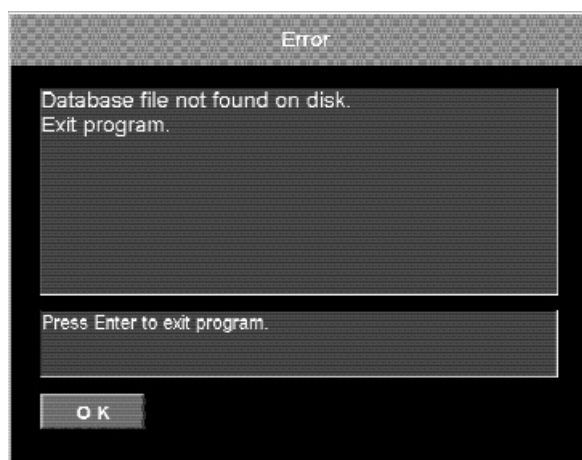


Fig. 14

7. When the database is updated, a confirmation screen is displayed.

To quit, click the **OK** button or press the Enter key on your keyboard. (Fig. 15)

To return to the first menu screen, click the **Cancel** button or press the Esc key on your keyboard.

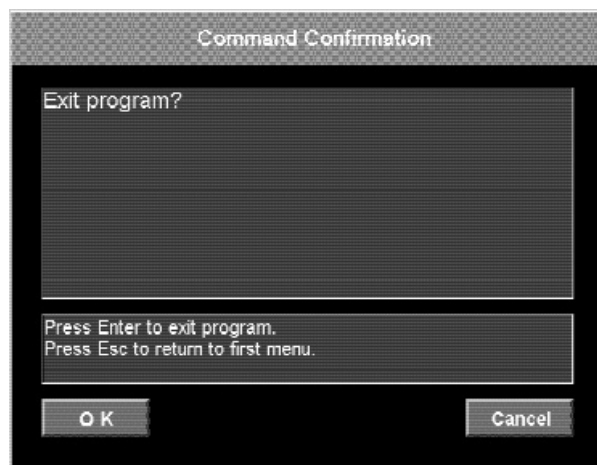


Fig. 15

**NOTE:**

If the OK button is clicked, the program is exited.

Start the program again and check that the database version indicated in the first menu is J1.00. (Fig. 16)

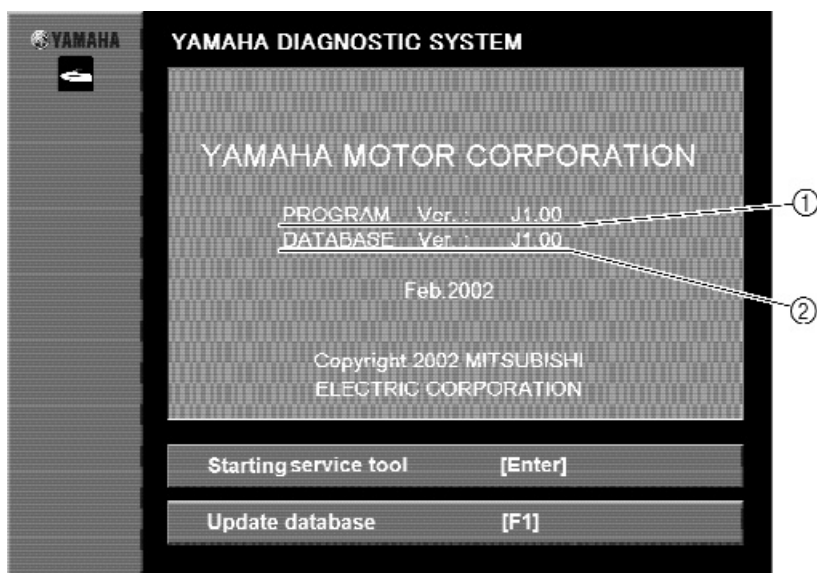


Fig. 16

① Program version

② Database version

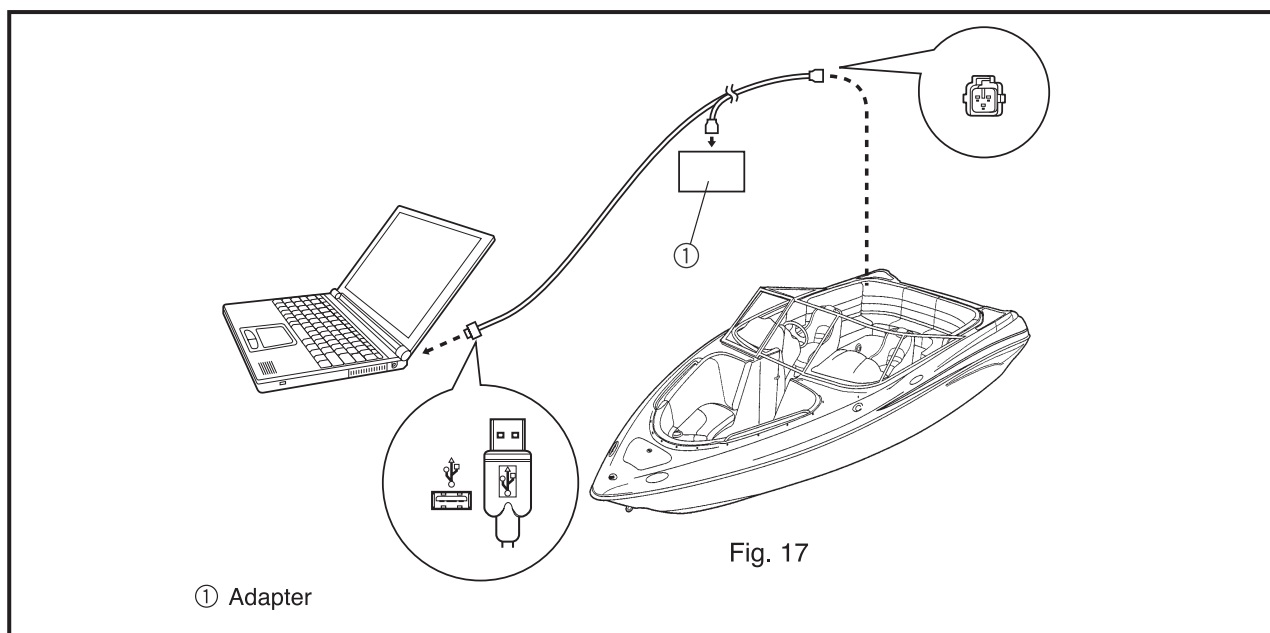
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## OPERATING CONNECTING THE COMPUTER TO THE WATERCRAFT

**NOTE:**

Be sure to use the enclosed communication cable to connect the computer and adapter to the watercraft.

1. Quit any applications that are running, and then turn off the computer.
2. Connect the communication cable to the 3-pin communication coupler of the watercraft, the adapter, and the communication port of your computer.

**NOTE:**

Use either the COM1 or COM2 port, and, if necessary, set the serial port as specified in the computer's manual. Set the serial port where the RS232C (Dsub-9 pin) cable is connected to COM1 or COM2. You may also use the USB port of your computer if it is so equipped.

3. Connect a 12 V battery to the watercraft.

**NOTE:**

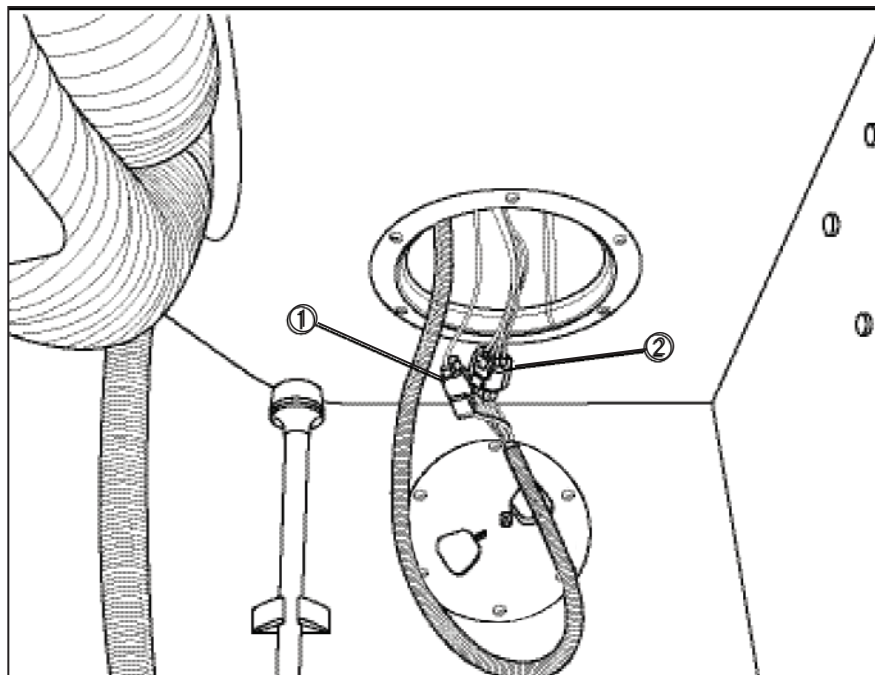
The following items should be checked before starting the Yamaha Diagnostic System.

- The battery is properly charged and its specific gravity is within specification.
- There are no incorrect wiring connections.
- Wiring connections are properly secured and are not rusty.
- There is enough fuel in the fuel tank.

## CONNECTING THE COMMUNICATION CABLE TO THE WATERCRAFT

Models: FX140

Top view



① 3-pin communication coupler

② Wire harness coupler

**NOTE:**

Be careful not to pinch the communication cable between the **hood** and the **deck** or to damage it.

---

## OPENING THE YAMAHA DIAGNOSTIC SYSTEM

1. Push the start switch to start the engine.
2. Turn on your computer and start up Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP.
3. From the taskbar at the bottom of your computer screen, click the **Start** button (Fig. 19), point to **Programs**, and then click **YAMAHA DIAGNOSTIC SYSTEM for WaterCraft**.

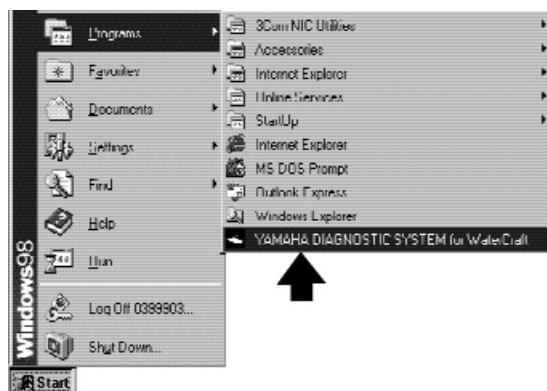


Fig. 19

4. Open the Yamaha Diagnostic System window. (Fig. 20) After about three seconds, the display will automatically go to the first menu, or click or press any key to go to the first menu. (See fig. 21.)



Fig. 20

5. Click the **Starting service tool [Enter]** button or press the Enter key on your keyboard.  
(Fig. 21)

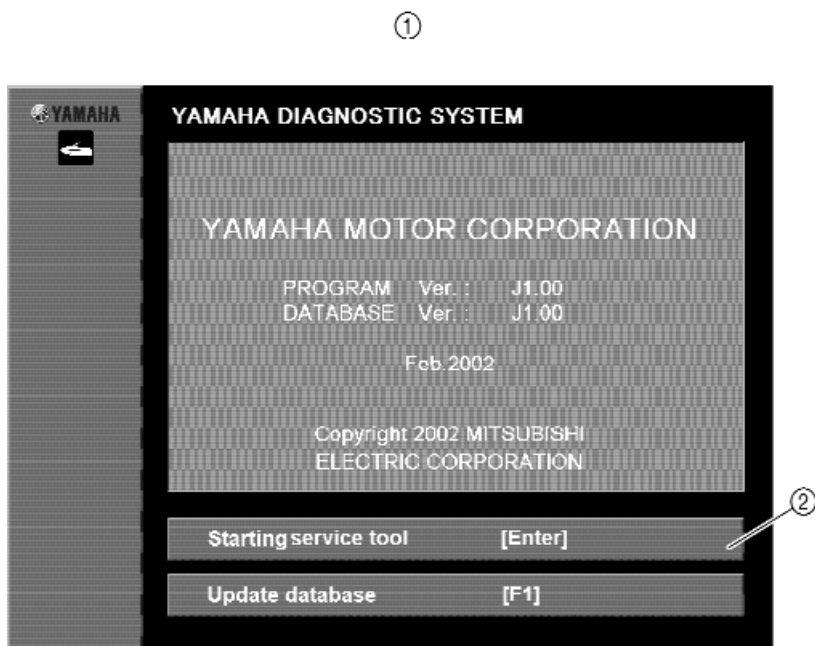


Fig. 21

- ① First menu  
② Click to start service tool

**NOTE:**

- If an error message appears and the program stops operating, follow the error messages.
  - If the program doesn't start, an error message will explain the problem. If the program doesn't start and an error message is not displayed, the cause of the problem is most likely insufficient computer memory.
  - To cancel, press the ESC key on your keyboard.
-

6. Click or press any key to display the main menu.

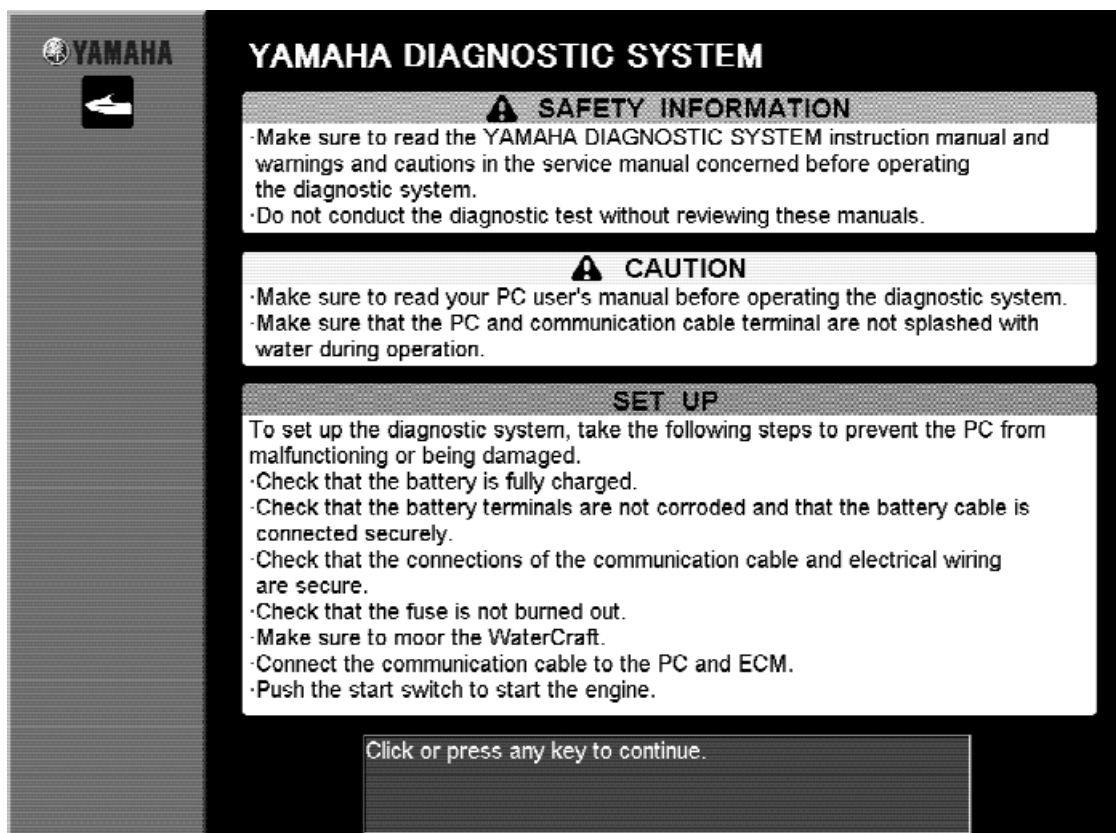


Fig. 22

**NOTE:**

If a diagnosis record is stored in the ECM, "Diagnosis record available," appears as a confirmation message before the Main Menu is displayed. (Fig. 23)



Fig. 23



## SELECTING COMMANDS FROM THE MAIN MENU

Eight commands appear in the main Menu. Select a command in any of the following three ways:

### Two ways to select command:

- Move the mouse pointer over the selected command (a) or (b) until it appears as a finger mark, and then click the selected command.
- Press the number key (1–8) corresponding to the selected command.

①

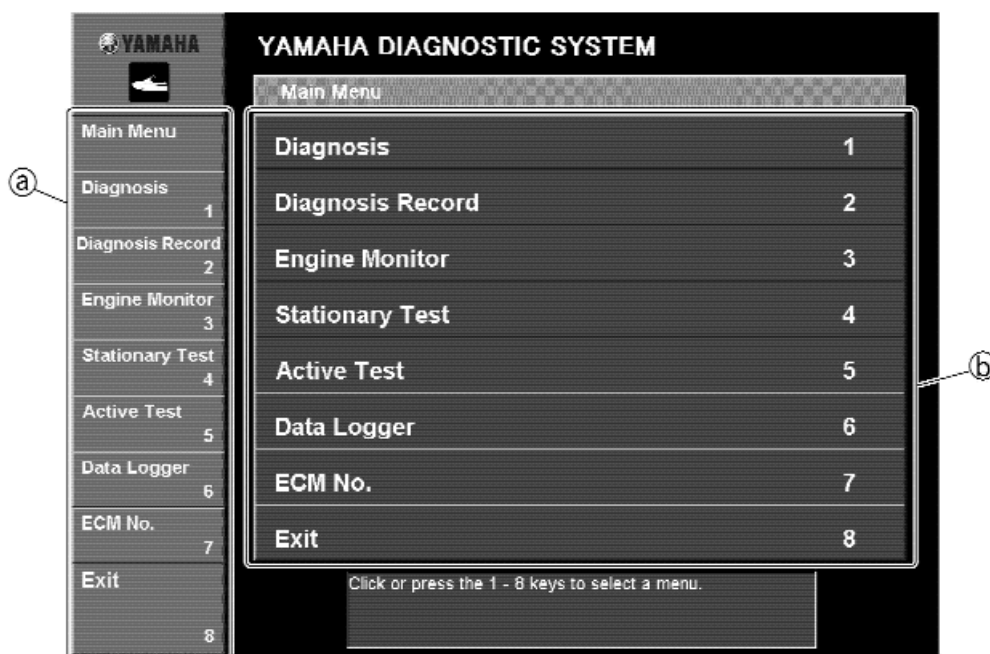


Fig. 24

① Main menu

### NOTE:

If the Main Menu is displayed and the engine is turned off, electric power is supplied to the ECM for 30 minutes and commands can be carried out.

## EXPLANATION OF EACH COMMAND

### 1. Diagnosis

The diagnosis codes, their corresponding part name, the diagnosing results, and the diagnostic criteria are listed.

List of items:

Condition of coils (pulser coils)

Condition of sensors (throttle position sensor, intake air temperature sensor, intake air pressure sensor, engine temperature sensor, and cam position sensor)

Condition of battery (battery voltage)

Operation of switches (slant detection switch)

### 2. Diagnosis record

The diagnosis code, its corresponding part name, oil pressure warning, overheat warning, the time of occurrence, and the total operation hours are listed. This command enables you to check the record of malfunctions, which will assist in reducing troubleshooting time. In addition, the diagnostic codes of malfunctions that have occurred can be deleted from the ECM.

The items are the same as those listed above for *Diagnosis*.

### 3. Engine monitor

The input signal of each sensor for the ECM is displayed.

In addition, the sensing item that is displayed can be changed.

Sensing items:

Sensors (throttle position sensor, intake air temperature sensor, intake air pressure sensor, and engine temperature sensor)

Voltage system (battery voltage)

Switches (engine shut-off switch, oil pressure switch, thermoswitch, and slant detection switch)

Operation signals (ignition and injectors)

### 4. Stationary test

With the engine off, operation tests are performed.

Test items:

Spark ignition coil for each cylinder

Fuel injector for each cylinder

Operation of the electric fuel pump

### 5. Active test

With the engine running, operation tests are performed.

Test items:

Dropped cylinder

**6. Data logger**

Two out of six items (engine speed, battery voltage, throttle position, intake air pressure, engine temperature, and oil pressure) are selected and 78 seconds of their recorded data are displayed on a graph. The operating time as compared to the engine speed and the total operating time are also displayed.

**7. ECM No.**

The ECM part number and model information are displayed.

**8. Exit**

The program is exited.

## DIAGNOSIS

The diagnosis codes of malfunctions recorded in the watercraft's ECM, the diagnosis codes' corresponding part name, the results of the diagnosis, and the condition of the part are listed.

Eight items can be displayed at one time.

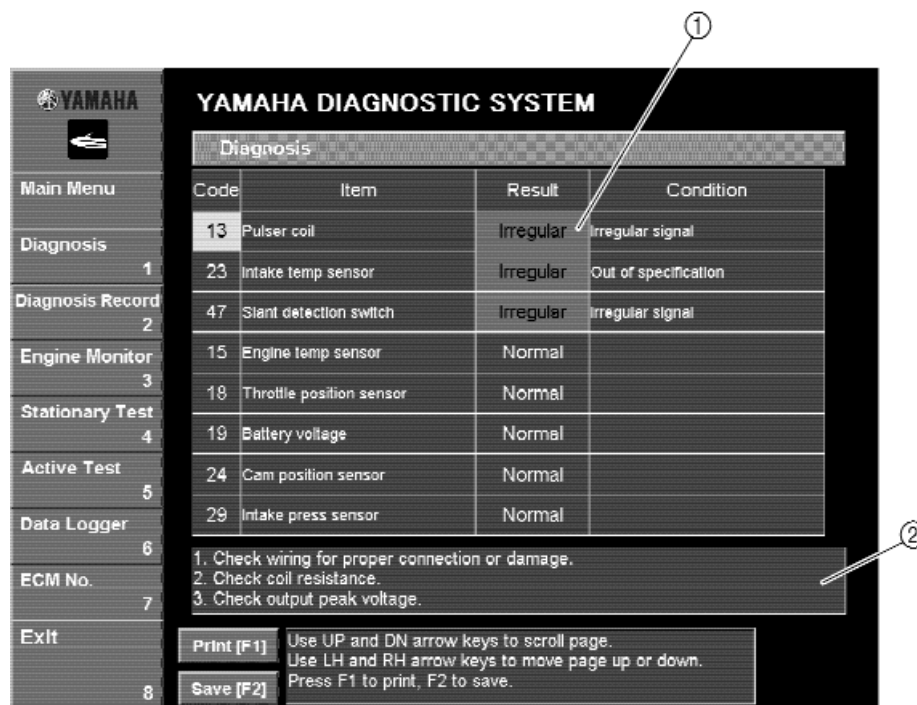


Fig. 25

- ① Other than Normal will be highlighted in red and will be listed from the top.
- ② Displays troubleshooting procedures for selected code.

### Operating procedure:

Select the code number that you wish to view a diagnosis for by either clicking it or pressing the up or down arrow keys on your keyboard.

### NOTE:

- Items where "Normal" does not appear in the **Result** column are displayed at the top of the list.
- The selected code is highlighted in light blue and its confirmation procedure is displayed below the table.

## Print

By selecting the **Print** command in the Diagnosis, Diagnosis record, Engine monitor, or Data logger mode, the data from the corresponding window can be printed.

1. Click the **Print [F1]** button or press the F1 key on your keyboard. The **Print** dialog box is displayed. (Fig. 26)

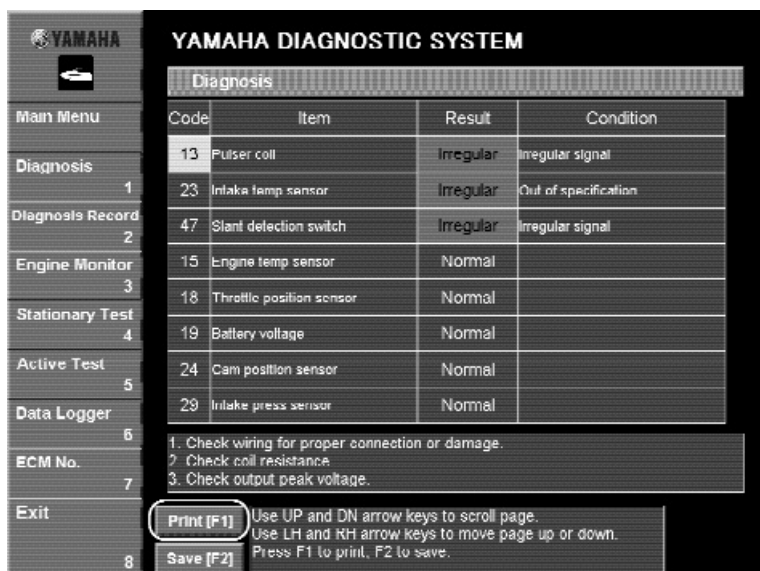


Fig. 26

2. Specify the printer, the printing range, and the number of copies to be printed.

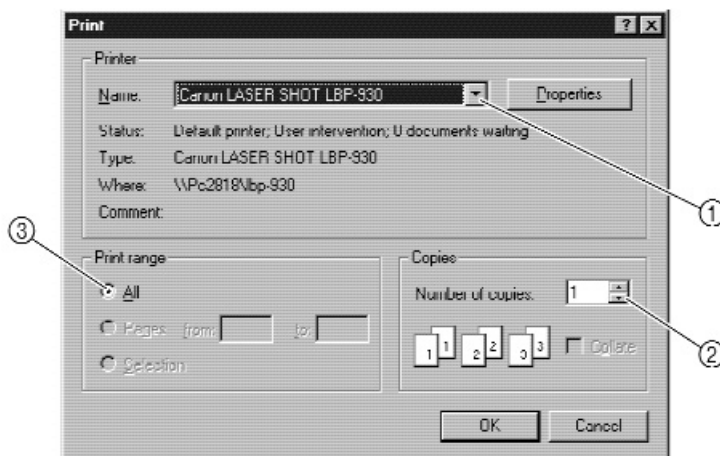


Fig. 27

- ① Select printer
- ② Select the number of copies
- ③ Select which page to print

3. Click the **OK** button to begin printing.  
To cancel printing, click the **Cancel** button.

**Save**

By selecting the **Save** command in the Diagnosis, Diagnosis record, Engine monitor, or Data logger mode, the corresponding data can be saved on a disk.

Operating procedure:

1. Click the **Save [F2]** button or press the F2 key on your keyboard. The **Save As** dialog box is displayed. (Fig. 28)

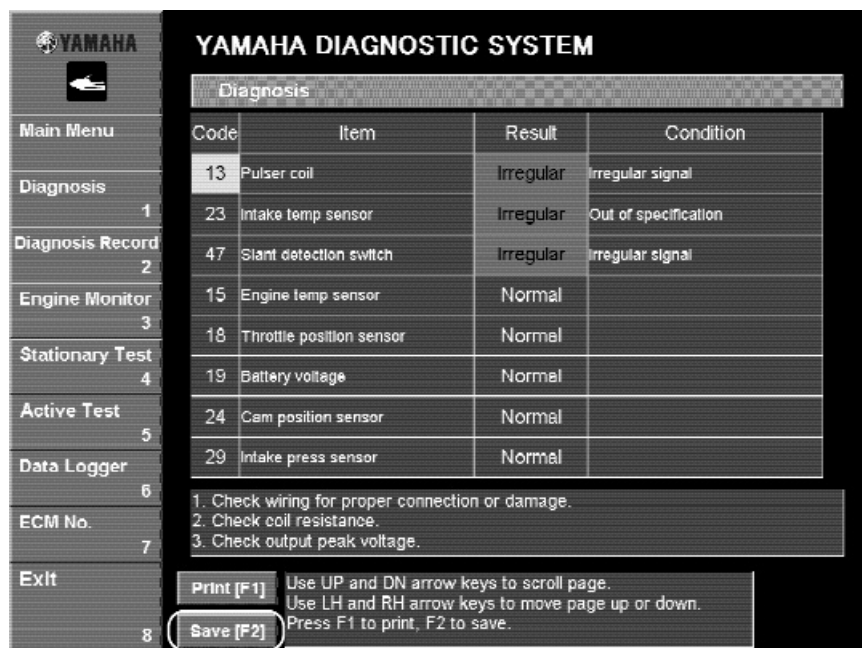


Fig. 28

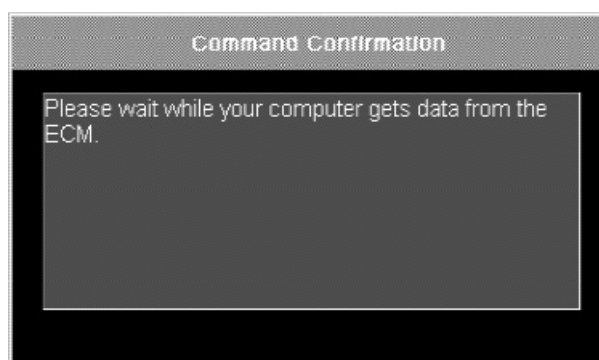


Fig. 29

2. Select the disk and folder where the data will be saved and specify its file name. (Fig. 30)

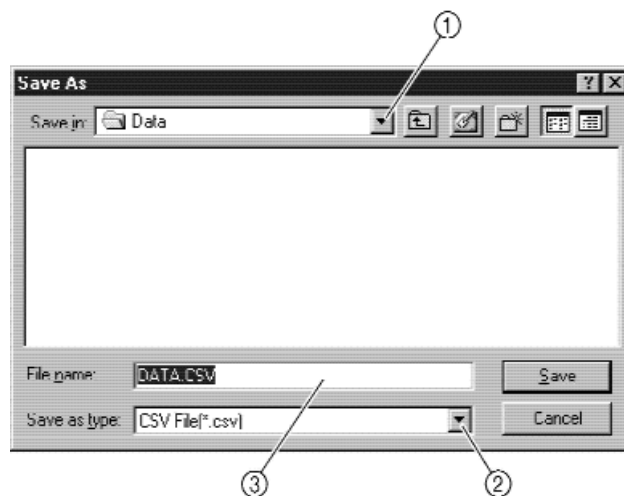


Fig. 30

- ① Choose folder to save in
- ② Choose type of data
- ③ Input file name

3. Click the **Save** button to save the data.

To cancel saving, click the **Cancel** button. (Fig. 30)

The data you saved can be viewed in Microsoft® Excel. (Fig. 31)

	A	D	O	D	E
1	Save date	September 10 2000			
2	ECM No.	60E9601A01			
3					
4	Diagnostic				
5		Code	Item	Result	Condition
6			15 Engine temp sensor	Irregular	Out of specification
7			13 Pulser coil	Normal	
8			18 Throttle position sensor	Normal	
9			19 Battery voltage	Normal	
10			23 Intake temp sensor	Normal	
11			24 Cam position sensor	Normal	
12			29 Intake press sensor	Normal	
13			47 Slant detection switch	Normal	
14					
15	Diagnosis Record				
16		Total hours of operation:		U	
17		Code	Item	Occurred	
18			Low oil pressure warning	0.05	
19			15 Engine temp sensor	0.05	
20					
21	Engine Monitor				
22		Monitor Item	Result	Unit	
23		Engine speed		0 r/min	
24		Intake pressure		100.42 kPa	
25		Intake pressure		29.66 inHg	
26		Atmospheric pressure		1004.2 hPa	
27		Atmospheric pressure		29.7 inHg	
28		Ignition timing	-	deg	
29		Battery voltage (12-16)		12.23 V	
30		TPS voltage (0.5-4.5)		0.762 V	
31		Throttle valve opening (0-90)		1.5 deg	
32		Fuel injection duration		0 ms	
33		Engine temperature (below 120)		34 -C	
34		Engine temperature (below 248)		93.2 -F	
35		Intake temperature (below 70)		21 -C	
36		Intake temperature (below 158)		69.8 -F	
37		Engine stop lanyard switch	OFF		
38		Overheat thermoswitch	OFF		
39		Slant detection switch	OFF		
40		Oil press switch	ON		
41					

Fig. 31



## DIAGNOSIS RECORD

The diagnosis codes of malfunctions that have been recorded in the watercraft's ECM, the diagnostic codes' corresponding part name, and the time when the malfunctions occurred are listed.

A maximum of five items can be displayed at one time. The oldest occurrence appears on top. In addition, diagnosis codes stored in the ECM can be deleted.

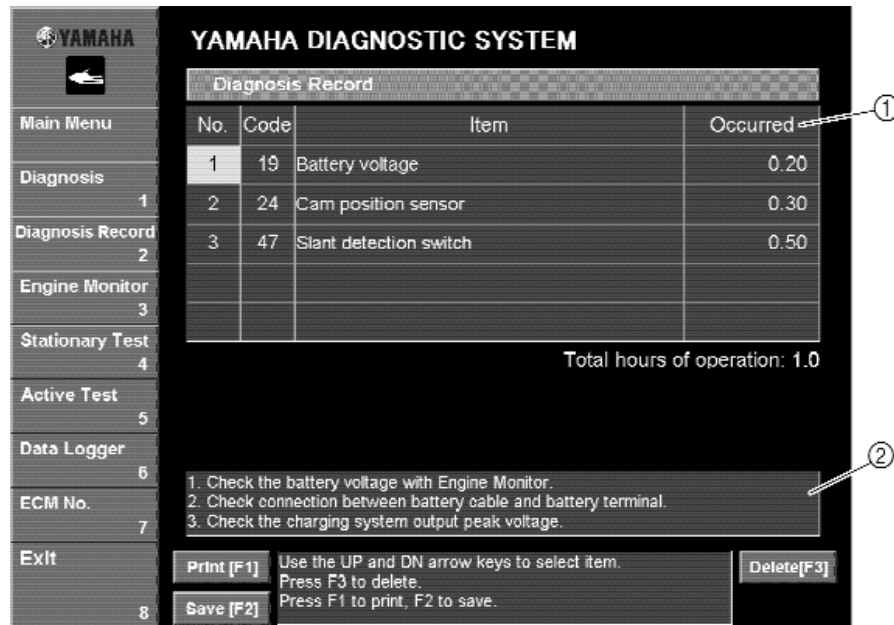


Fig. 32

- ① Displays time of occurrence .
- ② Displays troubleshooting procedures for selected code.

### NOTE:

When a Diagnosis record is not available, "Diagnosis Record is unavailable" is displayed. (Fig. 33)

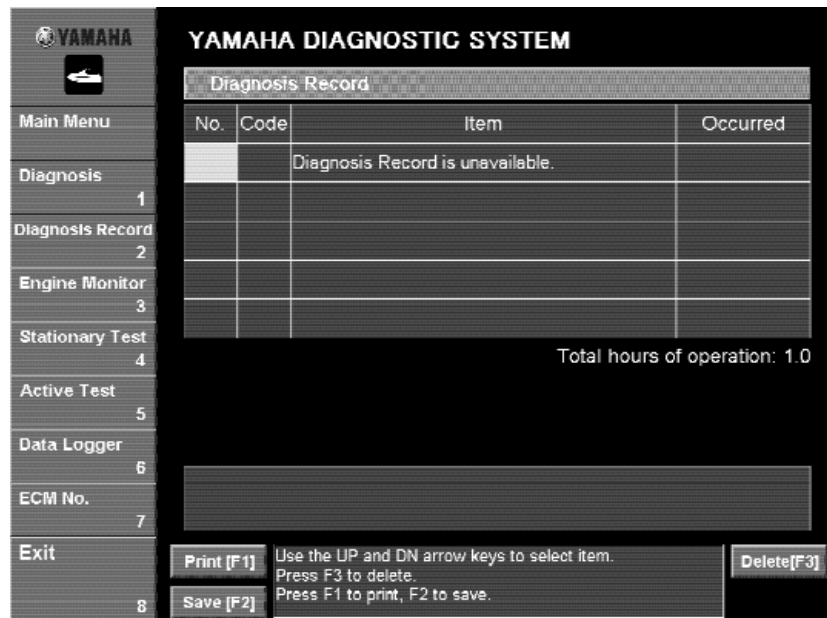


Fig. 33



**Deleting diagnosis record in the ECM:**

1. Select the item that you wish to delete by either clicking it or pressing the up or down arrow keys on your keyboard.

**NOTE:**

- The selected code is highlighted in light blue.
- Check that the items deleted are normal in the Diagnosis Record. If the items remain irregular, they will appear as irregular in the Diagnosis Record. Even if you try to delete them, they are undeletable.

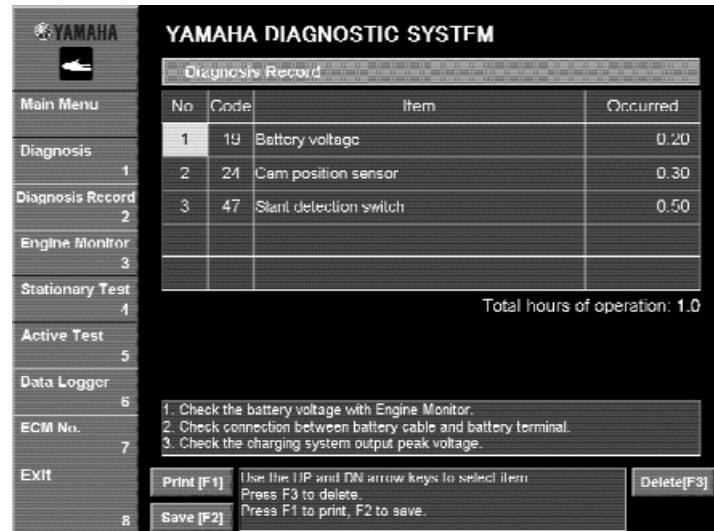


Fig. 34

2. Click the **Delete [F3]** button or press the F3 key on your keyboard. (See fig. 33.) A confirmation message appears. (Fig. 35)

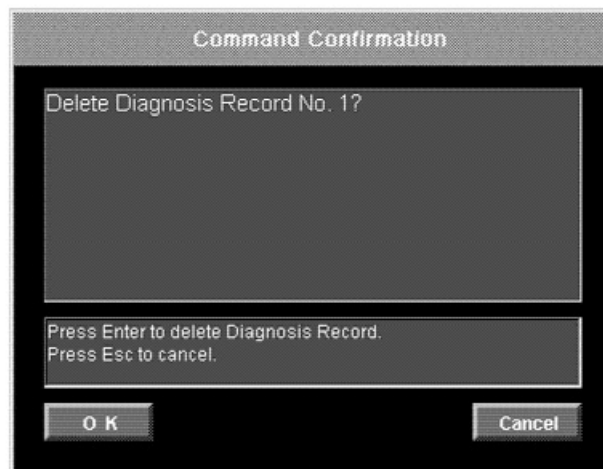


Fig. 35

3. Click the OK button or press the Enter key on your keyboard (Fig. 35): The selected item is deleted. To cancel deleting the item, click the **Cancel** button or press the Esc key on your keyboard.

**NOTE:**

\_\_\_\_\_

If an error occurs while an item is being deleted, an error message appears. Follow the instructions that appear in the error message. (Fig. 36)



Fig. 36

## ENGINE MONITOR

**⚠ WARNING**

Do not use the Engine Monitor function to check the engine condition while operating a watercraft, otherwise, you could become distracted which could result in a collision.

**CAUTION:**

Be sure to avoid splashing water on the computer, adapter, and communication cable, and to avoid damaging them with strong sudden jolts or vibration.

The data from the ECM of the watercraft is displayed.

Ten items can be displayed at one time. To view the other items, scroll the display. Displayed items can be changed as necessary.

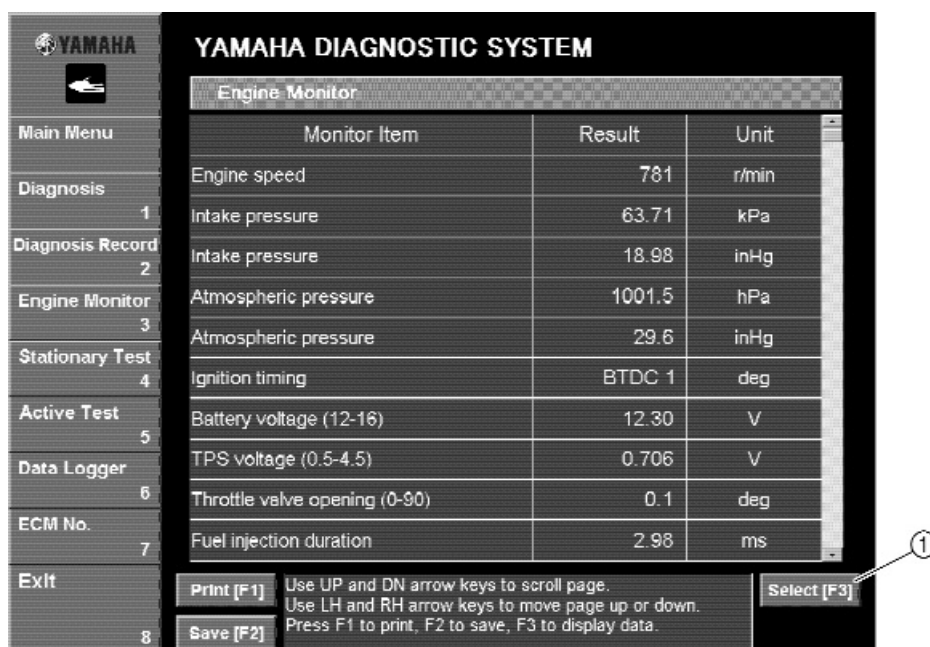


Fig. 37

① Click to go to item selection display.

**Operating procedure:**

1. To scroll the display and view other items, click ▲ or ▼ in the scroll bar or press the up or down arrow keys on your keyboard.
2. To change a displayed item, click the **Select [F3]** button or press the F3 key on your keyboard.
3. Select an item by either clicking it or pressing the up or down arrow keys on your keyboard, and then press the space bar. (Fig. 38)

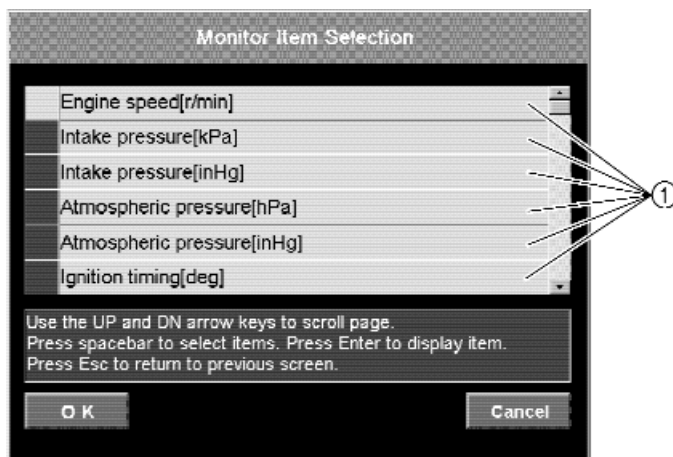


Fig. 38

① Selected items

**NOTE:**

- Selected items have a light blue background. Items that are not selected have a blue background. The box to the left of items that are being moved are light blue. Items that are not selected appear in blue.
- At initialization, all items are displayed.

4. Click the **OK** button or press the Enter key on your keyboard. The **Engine monitor** window appears. To cancel the monitor, click the **Cancel** button or press the Esc key on your keyboard (Fig. 38).

## STATIONARY TEST

Selecting this command displays a window where stationary tests (spark ignition coil #, operate injector #, and operate electric fuel pump) can be selected.

### **⚠ WARNING**

Avoid clicking the Execute and Cancel buttons repeatedly, otherwise, the ECM or PC will not work properly and they could be damaged.

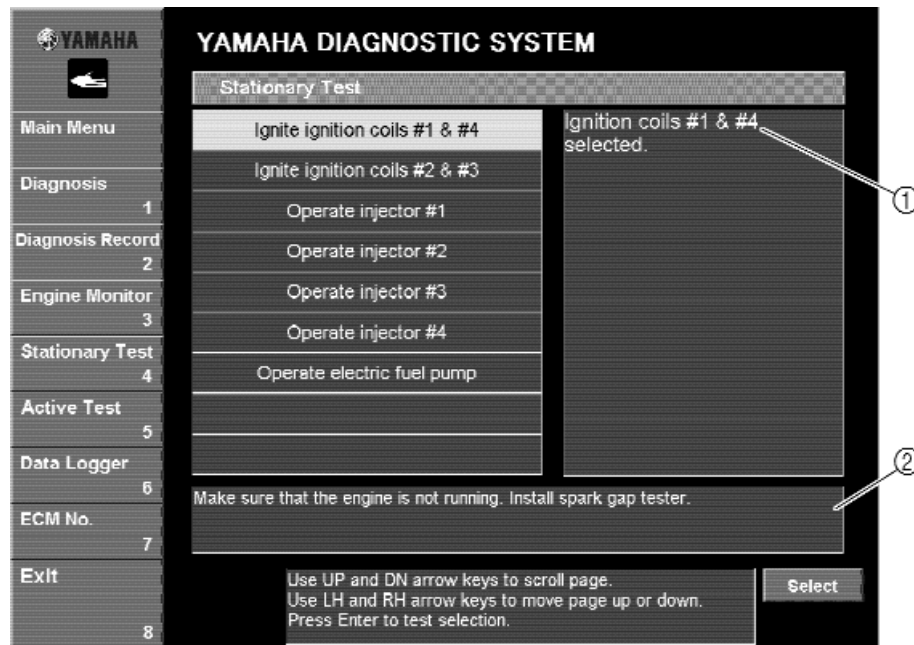


Fig. 39

- ① Explanation of selected item.
- ② Confirmation item before the test.

### Sparking ignition coil procedure:

A voltage is applied to the ignition coil of the selected cylinder, a spark is created in the spark gap tester, and then the ignition system is checked. Five sparks are created within five seconds.

### **⚠ WARNING**

- Do not touch any connections of the spark gap tester lead wires.
- Do not let sparks leak out of the removed spark plug cap.
- Keep flammable gas or liquids away since this test will produce sparks.

1. Select the test that you wish to perform by either clicking it or pressing the up or down arrow keys on your keyboard (Fig. 39).

**NOTE:**

- Make sure that the engine is not running.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.
- A special tool (Spark Gap Tester YM-34487/90890-06754) is needed.

2. Connect the spark plug cap of the cylinder that will be tested to the spark gap tester.

Spark gap tester

☐ A YM-34487 / ☐ B 90890-06754

3. Set the spark gap length on the adjusting knob.

Ignition spark gap: 7–8 mm (0.28–0.31 in)

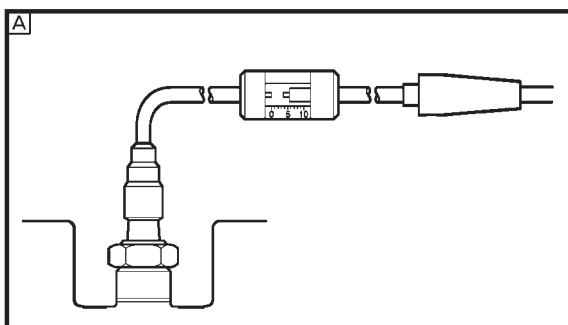


Fig. 40

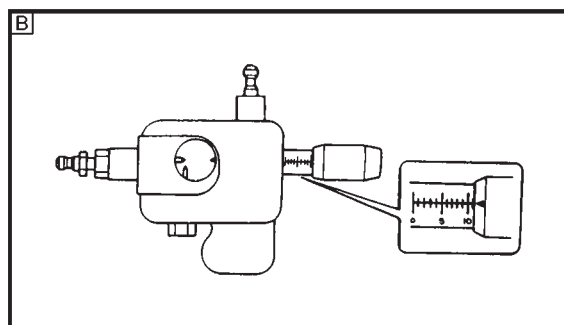


Fig. 41

4. Select the cylinder number where the spark gap tester is connected, and then click the **Select** button or press the Enter key on your keyboard (Fig. 39).

5. Click the **Execute** button or press the Enter key on your keyboard (Fig. 42).

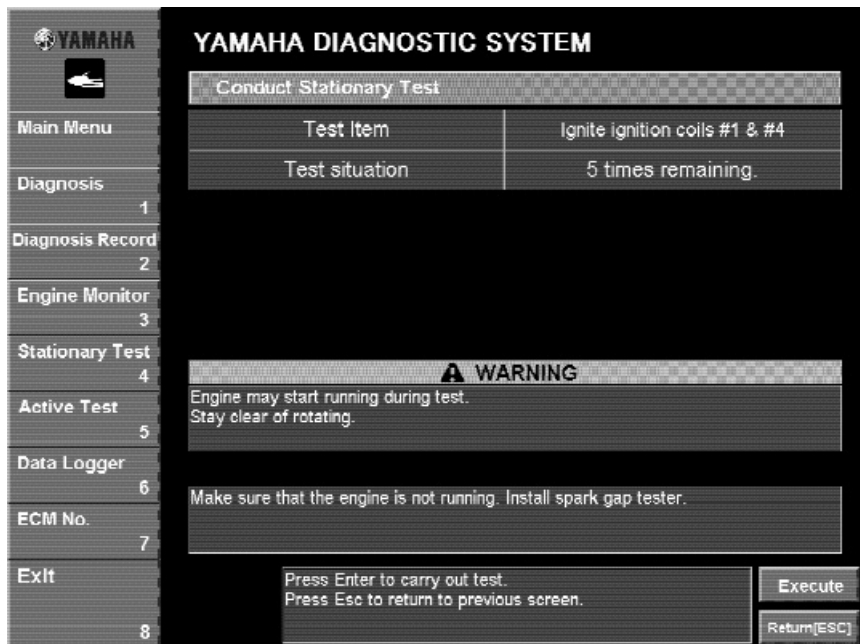


Fig. 42

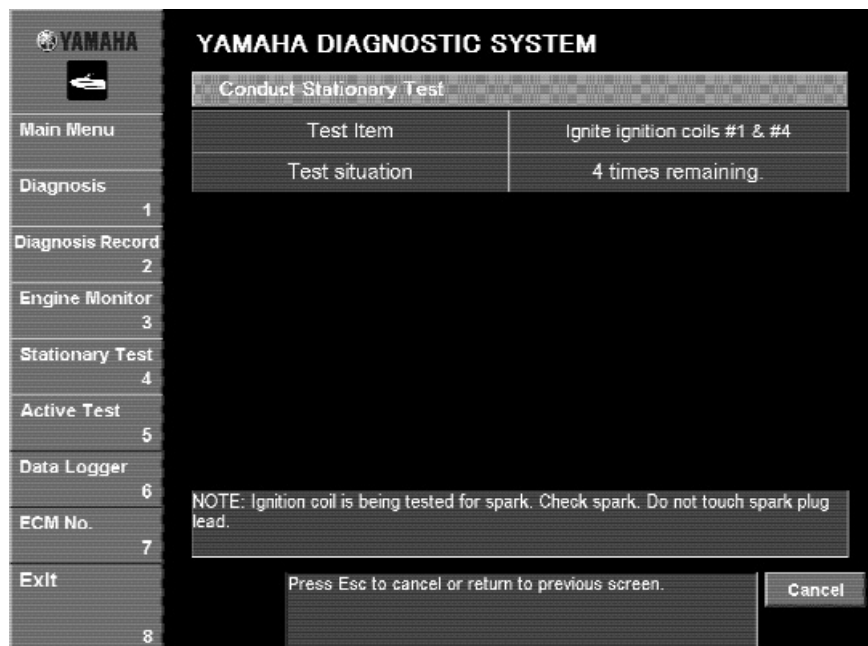


Fig. 43

**NOTE:**

If the engine is running an error message is displayed, follow the instructions that appear (Fig. 44).

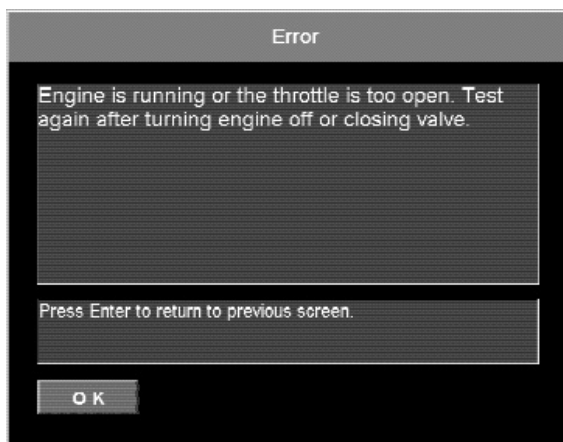


Fig. 44

6. While checking the information that appears in the **Test situation** column, follow the test instructions in the messages that are displayed (see Fig. 43).

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear in the error message (Fig. 45).

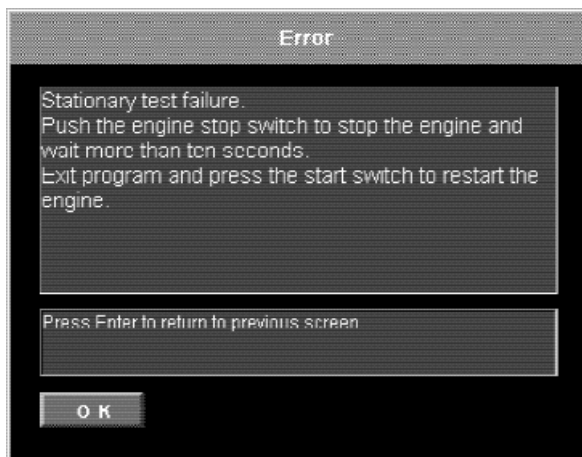


Fig. 45

7. To stop the stationary test, click the Cancel button (see Fig. 43).
8. Observe the spark through the discharge window of the spark gap tester.



9. To perform the test again to the same cylinder, click the **Execute** button or press the Enter key on your keyboard. To perform the test on a different cylinder, click the **Return [ESC]** button or press the Esc key on your keyboard to return to main menu where a different test can be selected (Fig. 46).

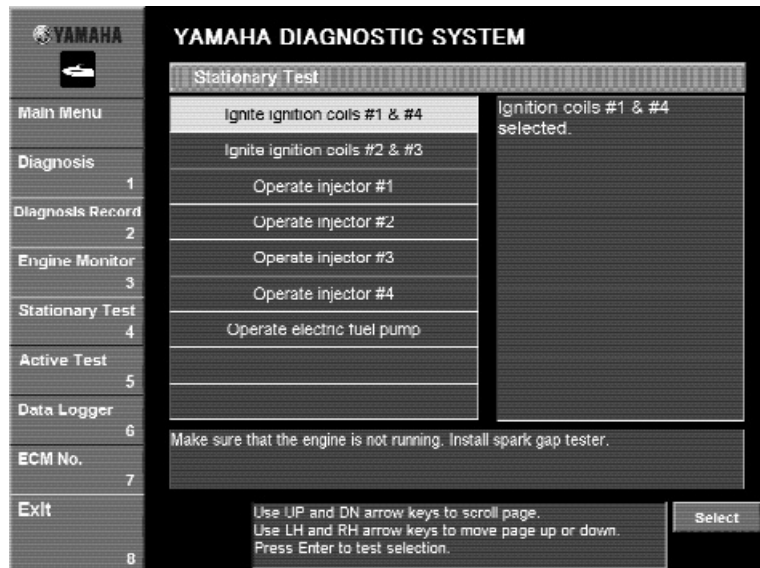


Fig. 46

**NOTE:**

If an error occurs while the test is being performed, the following message is displayed (Fig. 47).



Fig. 47

**Operating injector procedure:**

A voltage is applied to the injector of the selected cylinder, the injector is activated, and then the fuel system is checked. The fuel is injected 20 times within two seconds.

**⚠ WARNING**

- Do not perform the test with the injector removed from the throttle body or with any fuel system parts removed. High-pressure fuel could spurt out.
- When performing this operation, keep all sparks, flames, or other sources of ignition away from the testing area. Gasoline is highly flammable.

1. Select the test that you wish to perform by either clicking it or pressing the up or down arrow keys on your keyboard (Fig. 48).

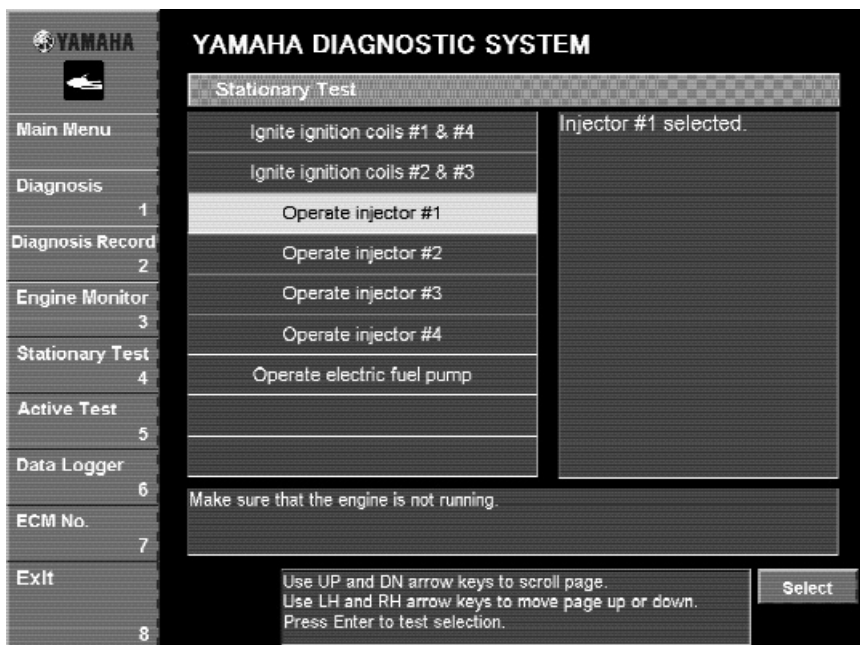


Fig. 48

**NOTE:**

- Make sure that the engine is not running.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.
- Make sure that there is fuel in the fuel tank, otherwise, an error will occur and the test cannot be performed.

2. Select the cylinder to be tested, and then click the **Select** button or press the Enter key on your keyboard (Fig. 48).

3. Click the **Execute** button or press the Enter key on your keyboard (Fig. 49).

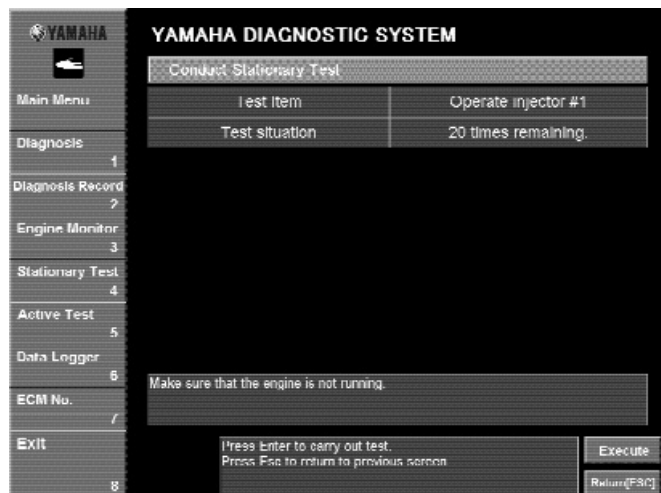


Fig. 49

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear.

4. Listen to the operating sound of the injector of the cylinder being tested.

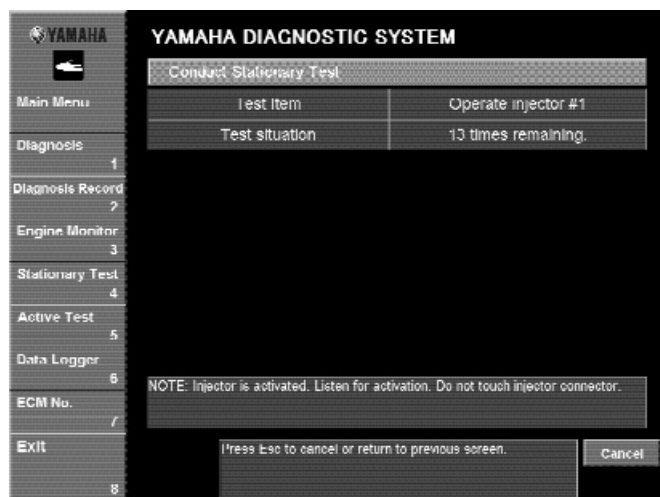


Fig. 50

**⚠ WARNING**

**Do not touch the injector connector.**

5. To perform the test again on the same cylinder, click the **Execute** button or press the Enter key on your keyboard. To perform the test on a different cylinder, click the **Return [ESC]** button or press the Esc key on your keyboard to return to the window where a different test can be selected (Fig. 51).

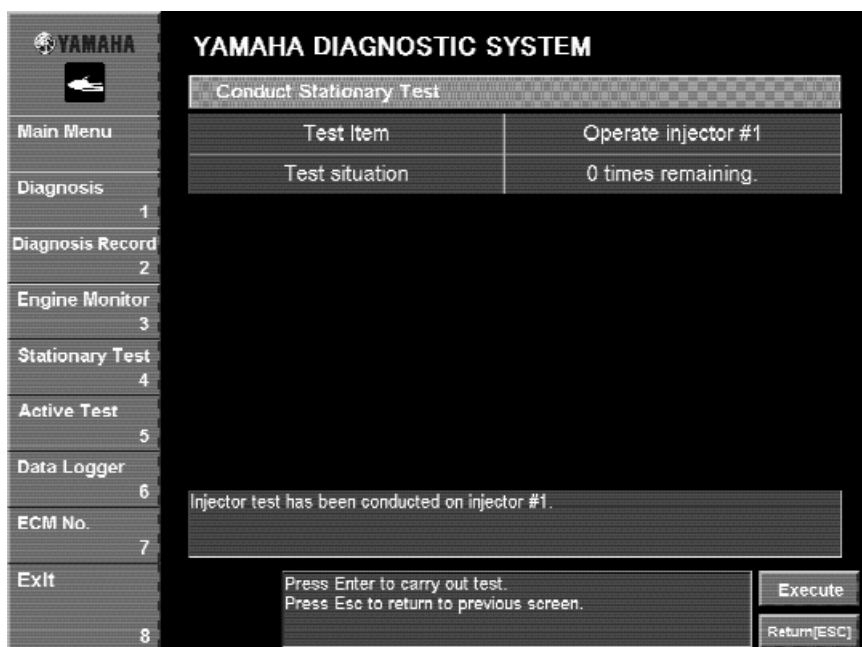


Fig. 51

**CAUTION:**

Do not test the same cylinder three or more times, otherwise, the spark plug insulator could be damaged.

**Operating the electric fuel pump:**

A voltage is applied to the electric fuel pump, the electric fuel pump is operated, and then the fuel system is checked. The electric fuel pump is operated for ten seconds.

**! WARNING**

- Do not perform the test with the injector removed from the throttle body or with any fuel system parts removed. High-pressure fuel could spurt out.
- When performing this operation, keep all sparks, flames, or other sources of ignition away from the testing area. Gasoline is highly flammable.

**NOTE:**

Make sure there is fuel in the fuel tank, otherwise, an error will occur and the test cannot be performed.

1. Select the test to be performed, then click the **Select** button or press the Enter key on your keyboard (Fig. 52).

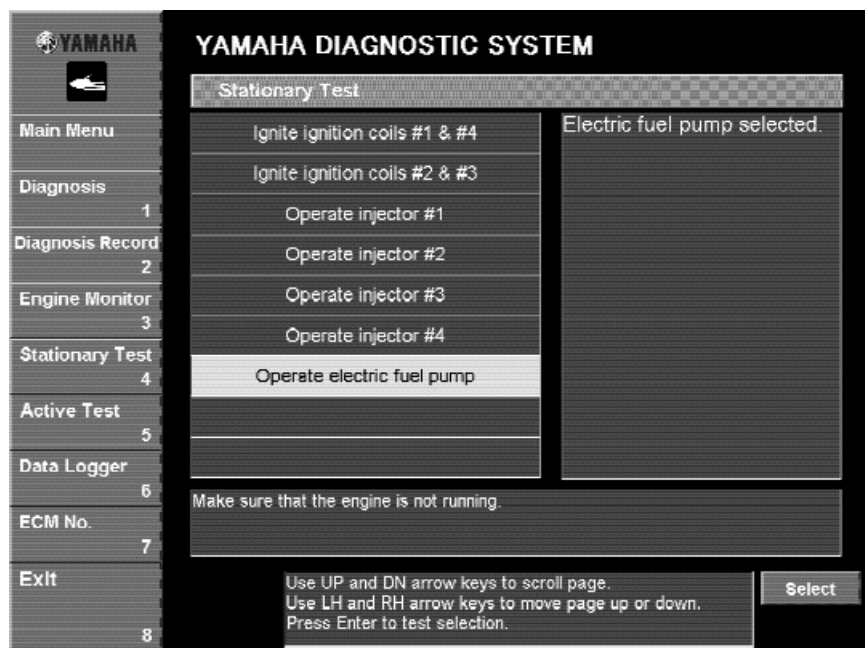


Fig. 52

**NOTE:**

- Make sure the engine is not running.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.

2. Click the **Execute** button or press the Enter key on your keyboard (Fig. 53).

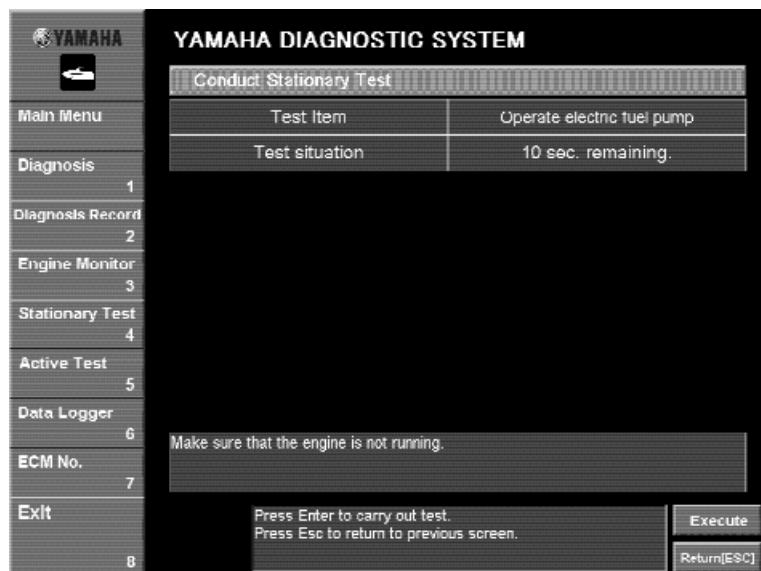


Fig. 53

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear.

3. Listen to the operating sound of the electric fuel pump.
4. To perform the test again, click the **Execute** button or press the Enter key on your keyboard. To perform a different test, click the **Return [ESC]** button or press the Esc key on your keyboard to return to the window where a different test can be selected (Fig. 54).

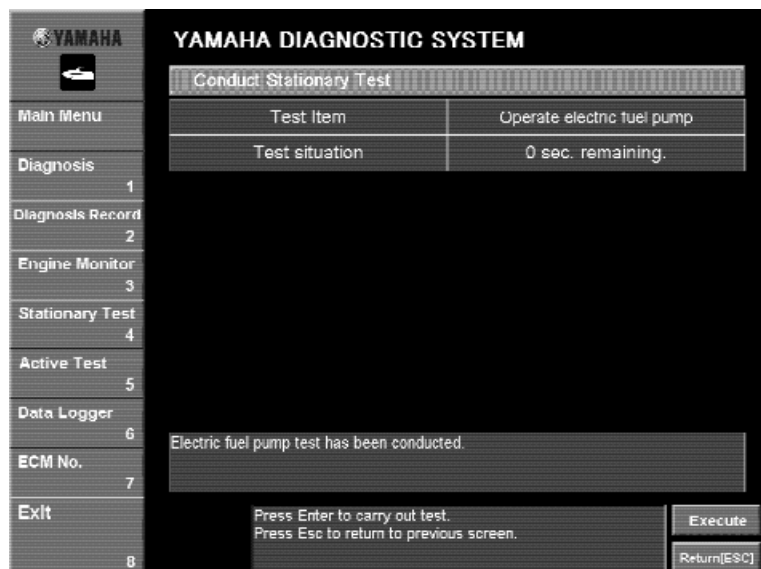


Fig. 54

**ACTIVE TEST**

Selecting this command displays a window where active tests can be selected.

**⚠ WARNING**

Avoid clicking the Execute and Cancel buttons repeatedly, otherwise, the ECM or PC will not work properly and they could be damaged.

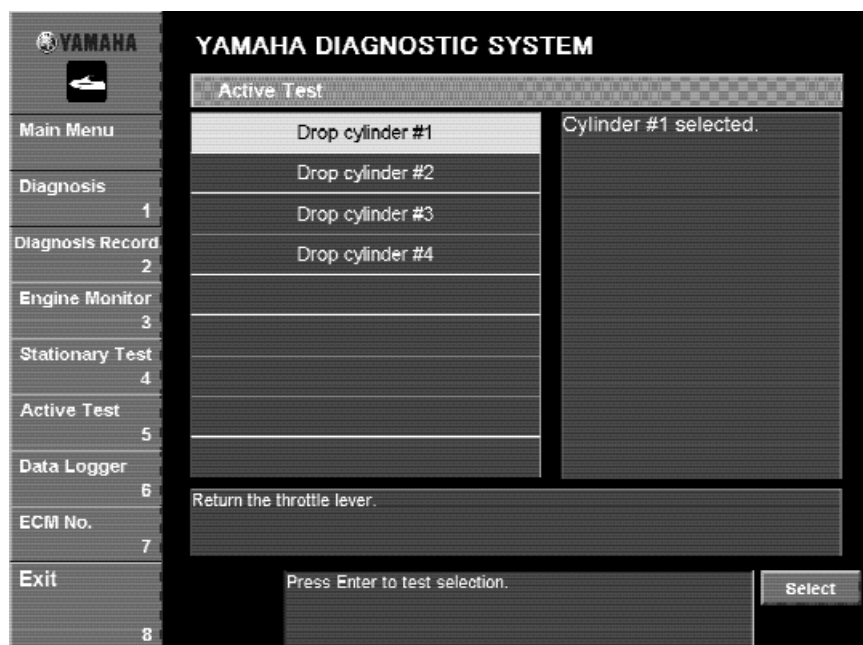


Fig. 55

**NOTE:**

The test can be carried out while the engine is running. It is not possible to carry out the test while the watercraft is running.



**Dropping a cylinder:**

Start the engine and observe the changes in engine speed for 20 seconds.

For the first ten seconds, operate all four cylinders, then stop one cylinder for five seconds. For the last five seconds, operate all four cylinders.

A screen that allows you to select which ignition and fuel to cut is displayed.

1. Select which ignition and fuel you wish to cut by either clicking it or pressing the up or down arrow keys on your keyboard (Fig. 55).

**NOTE:**

- Release the throttle lever.
- The selected item is highlighted in light blue.
- The details of the selected test are displayed in the column on the right, and the items that must be either checked or performed before the test can start are displayed below the table.
- Only one item can be selected at one time.

2. Click the **Select** button or press the Enter key on your keyboard (Fig. 55).
3. Start the engine.
4. Click the **Execute** button or press the Enter key on your keyboard (Fig. 56).

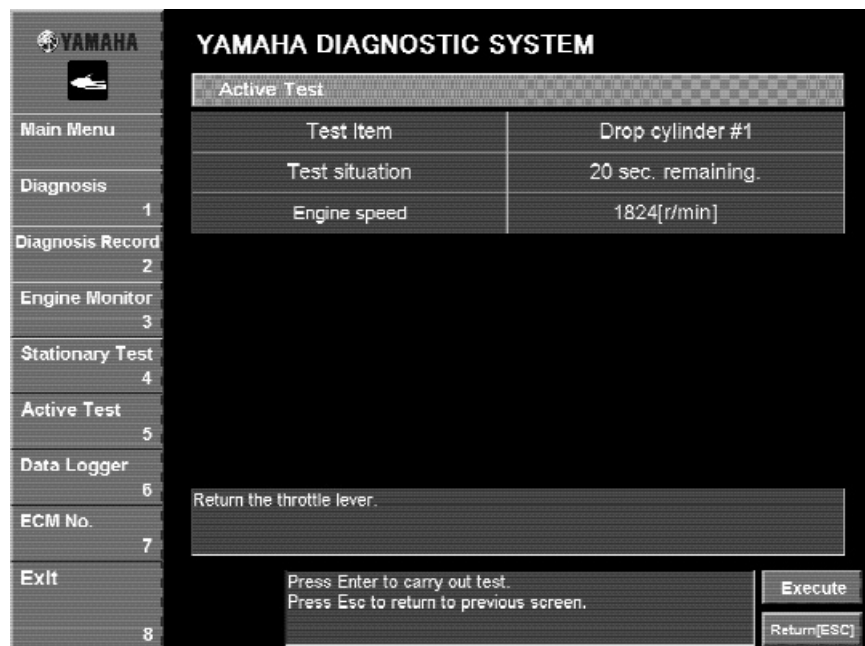


Fig. 56



**NOTE:**

If the engine is not running, an error message is displayed. Follow the instructions that appear (Fig. 57).

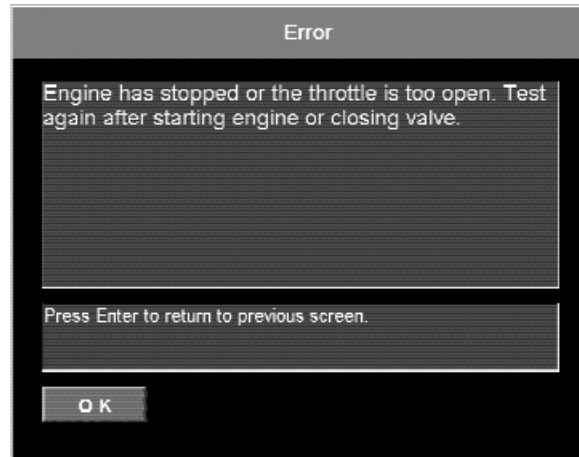


Fig. 57

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5. While checking the information that appears beside **Test situation** and **Engine Speed**, follow the test instructions in the messages that are displayed (Fig. 56).

**NOTE:**

If an error occurs while the test is being performed, an error message is displayed. Follow the instructions that appear (Fig. 58).

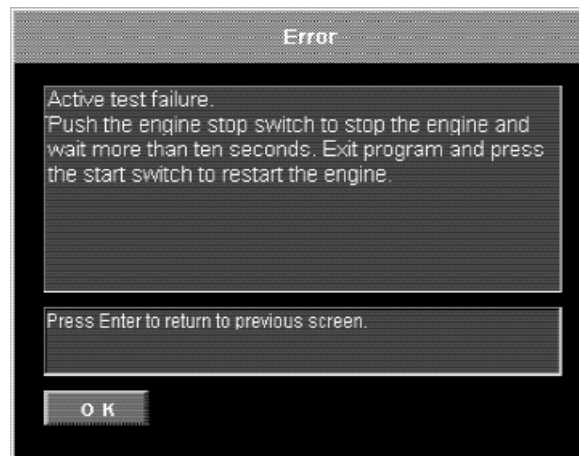


Fig. 58

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6. To perform the test again on the same cylinder, click the **Execute** button or press the Enter key on your keyboard. To perform a different test, click the **Return [ESC]** button or press the Esc key on your keyboard to return to the window where a different test can be selected.

**DATA LOGGER****Monitor item selection**

A window appears that allows you to select the **Data comparison graph** or the **Engine operating hours according to engine speed**.

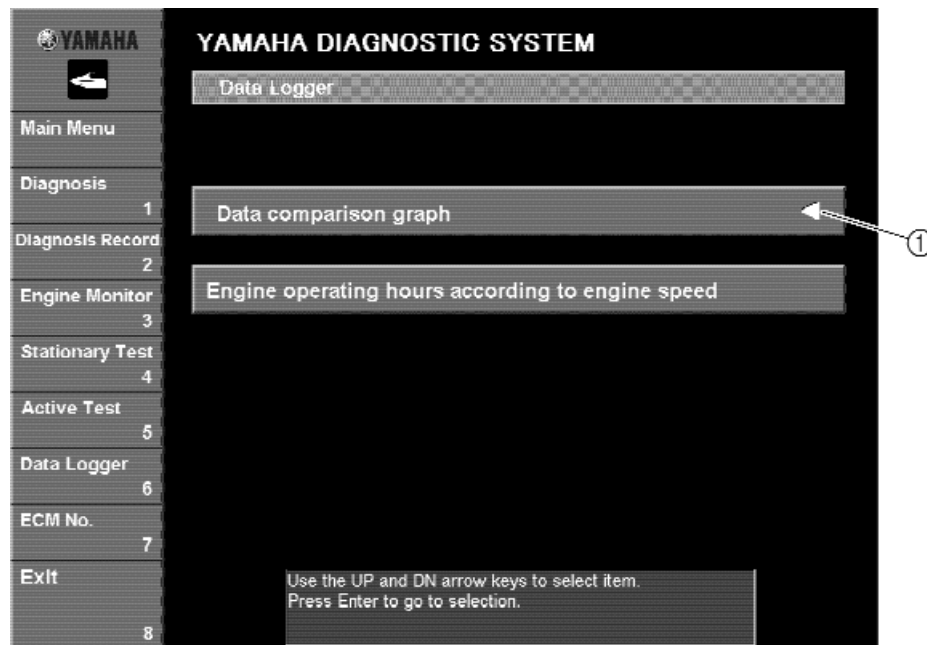


Fig. 59

① Triangle mark

**Operating procedure:**

1. Select the desired item by either clicking it or pressing the up or down arrow keys on your keyboard (Fig. 59).

**NOTE:**

A triangle appears to the right of the selected item.

2. Press the **Enter** key on your keyboard. The window of the selected item is displayed (Fig. 59).

### Data display item selection

A window appears that allows you to select the items to be graphed. No more than two items can be displayed.

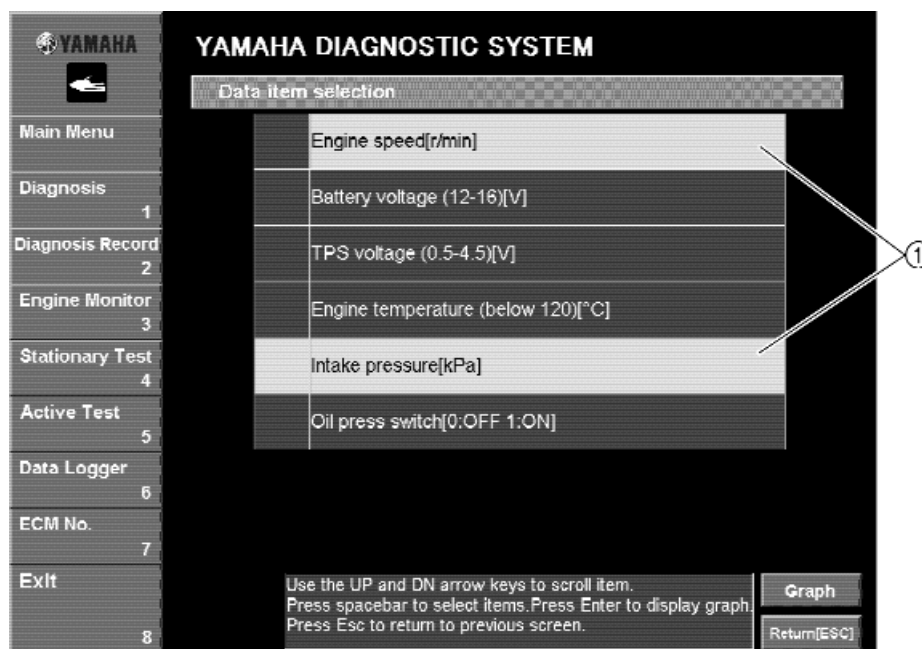


Fig. 60

① Selected items

### Operating procedure:

1. Select the desired items by either clicking them or pressing the up or down arrow keys on your keyboard, then pressing the space bar (Fig. 60).

### NOTE:

- Selected items have a light blue background. Items that are not selected have a blue background. The box to the left of items that are being moved are light blue. Items that are not selected appear in blue.
- At initialization, **Engine speed [r/min]** is selected.

2. Click the **Graph** button or press the Enter key on your keyboard. (Fig. 60) The **Data comparison** window is displayed (See fig. 61).

**Data comparison graph**

A line graph appears with the items selected in the **Data display item selection** window on the vertical axes and the **Time before engine stop** on the horizontal axis (Fig. 61).

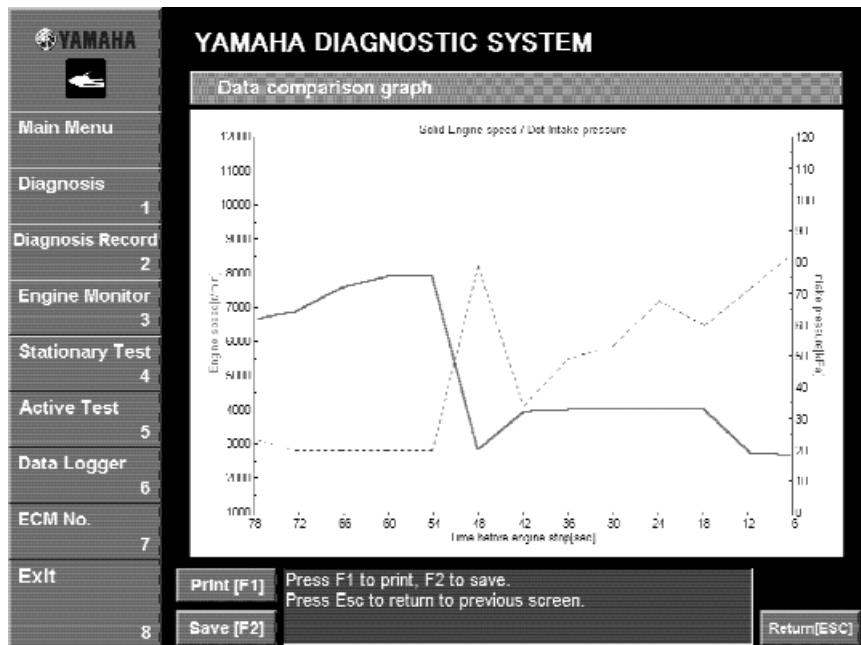


Fig. 61

**NOTE:**

- The item on the left vertical axis is graphed with a solid line and the item on the right vertical axis is graphed with a dotted line.
- Although the engine is running, graphs do not show the present engine condition. It displays the value at the time the **Enter** key on your keyboard was pressed in the **Monitor item selection**.

### Engine operating hours according to engine speed

The operating hours as compared to the engine speed and the total operating hours are displayed (Fig. 62).

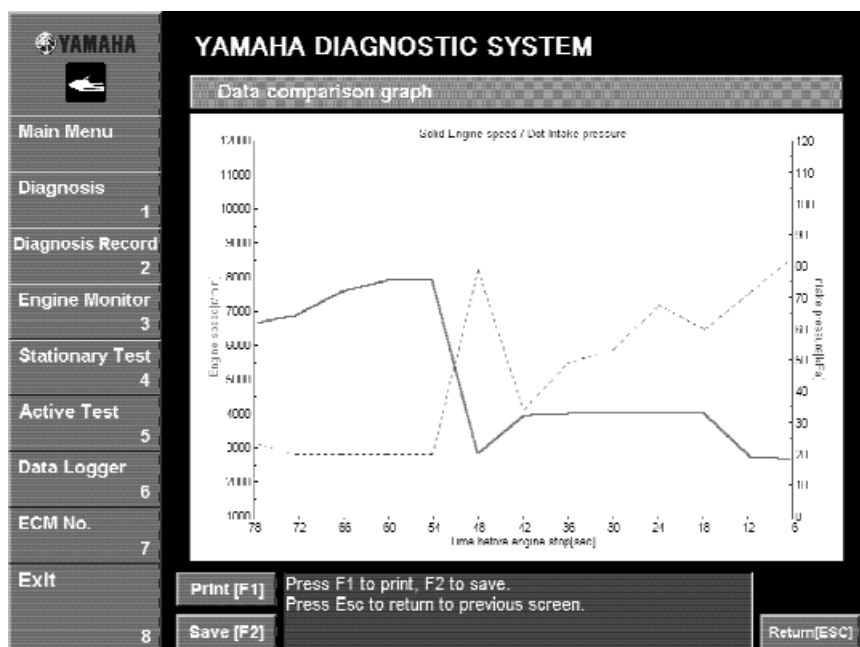


Fig. 62

A window is displayed showing the amount of hours that the engine is operated at each engine speed range.

#### NOTE:

- Although the engine is running, the displayed time refers to the added hours until the Data logger starts.
- The sum of the **Engine operating hours according to engine speed** is not equal to the total hours of operation since the hours are rounded to two decimals.

**ECM No.**

The ECM part number of the watercraft is read from the ECM and is displayed (Fig. 63).



 <b>YAMAHA</b>		<b>YAMAHA DIAGNOSTIC SYSTEM</b>	
		Engine operating hours according to engine speed	
Main Menu		Engine speed	Time[h]
Diagnosis		- 2000 r/min	1.10
1		2000 - 4000 r/min	0.00
Diagnosis Record		4000 - 6000 r/min	0.00
2		6000 - 8000 r/min	0.00
Engine Monitor		8000 - 10000 r/min	0.00
3		10000 - 12000 r/min	0.00
Stationary Test			
4			
Active Test			
5			
Data Logger		Engine hours	1.1
6			
ECM No.			
7			
Exit			
8			
Print [F1]		Press F1 to print, F2 to save. Press Esc to return to previous screen.	
Save [F2]		Return[ESC]	

Fig. 63

**EXIT**

The program is exited.

**Operating procedure:**

1. Click the **Exit** button or press any number key (1–8).

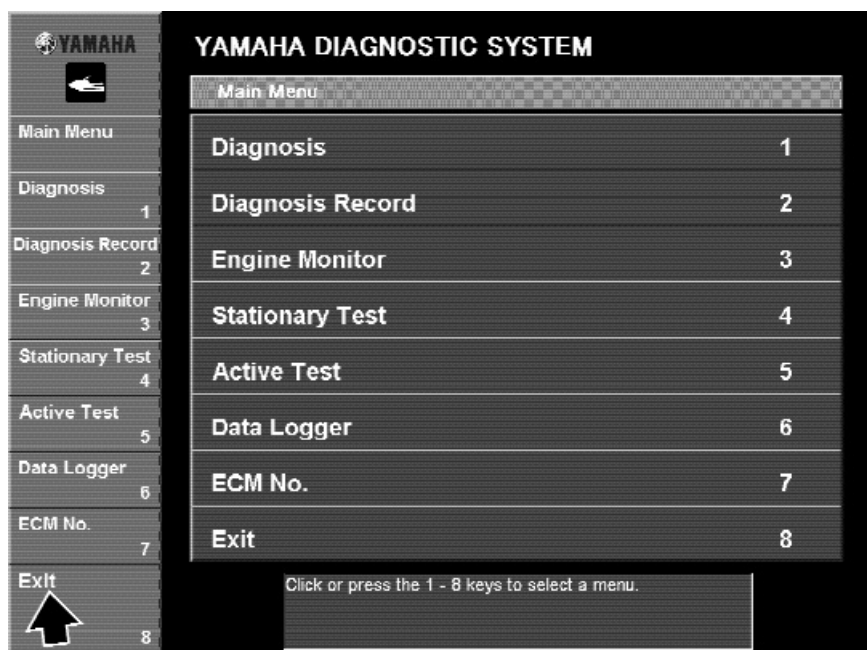


Fig. 64

2. Click the **OK** button or press the Enter key on your keyboard to exit the program.  
To cancel exiting the program, click the **Cancel** button or press the Esc key on your keyboard (Fig. 65).

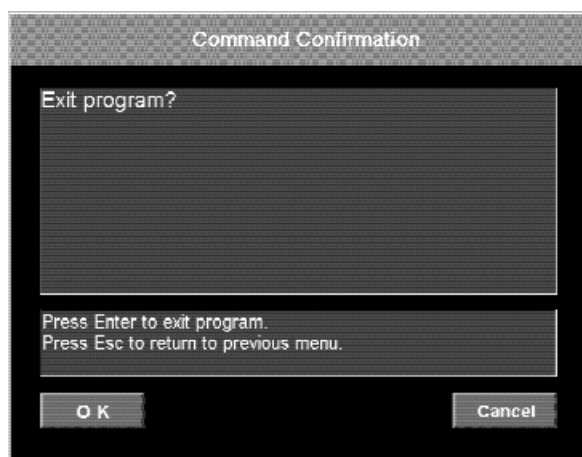


Fig. 65

## UNINSTALLING THE YAMAHA DIAGNOSTIC SYSTEM

Use the following procedure to uninstall the Yamaha Diagnostic System.

1. Exit all programs before running the uninstaller.
2. From the taskbar at the bottom of your computer screen, click the **Start** button, point to **Settings**, and then open the **Control Panel**.
3. In the Control Panel dialog box, double-click **Add/Remove Programs** (Fig. 66).



Fig. 66

4. Select **YAMAHA DIAGNOSTIC SYSTEM for WaterCraft** for **WaterCraft** and click the **Add/Remove** button (Fig. 67).

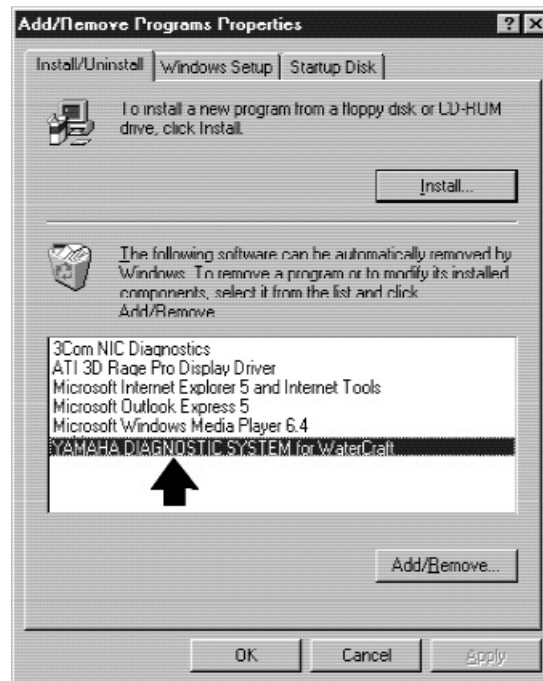


Fig. 67



5. Click the **Yes** button in the confirmation window to uninstall the utility software. To cancel the uninstall operation of the utility software, click the **No** button (see Figs. 68~70).

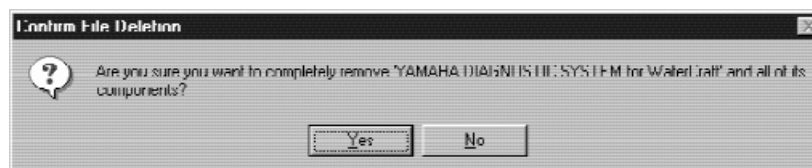


Fig. 68

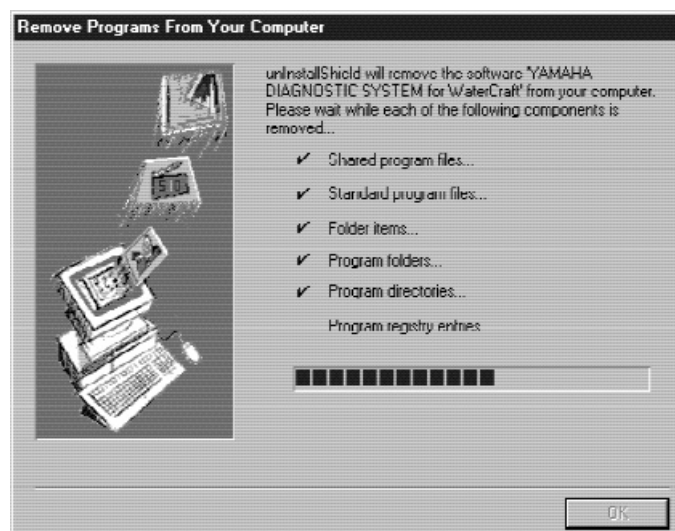


Fig. 69



Fig. 70

6. If the following message appears, click the **Details...** button.



Fig. 71

① Uninstall completed. Some elements could not be removed. You should manually remove items related to the application.

7. Check the contents of the message. If an element could not be removed, delete it manually.

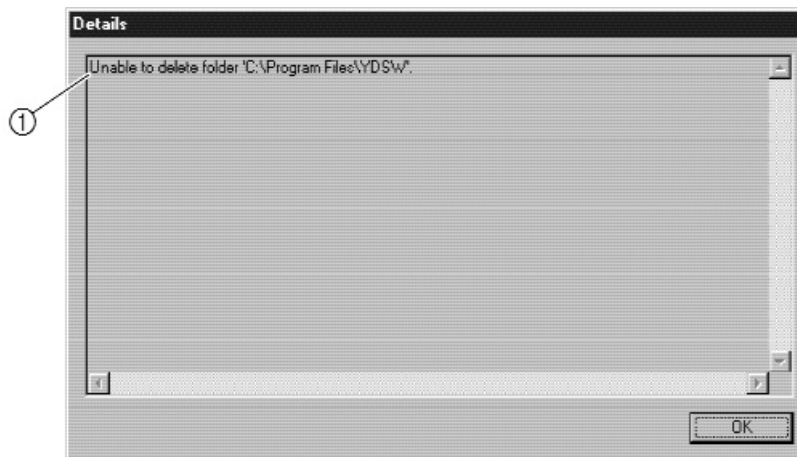


Fig. 72

① Elements that could not be removed.

## TROUBLESHOOTING

Error content	Cause	Action
Communication cable related error occurs	Communication cable is disconnected.	Connect communication cable between the computer's communication port and 3-pin communication coupler of the watercraft.
	Battery is disconnected from the watercraft.	Connect battery to watercraft.
	The battery voltage is below 12 V.	Connect battery of 12 V or higher.
Application does not start	The hardware does not meet the requirements to operate this application.	Use a computer that meets the specified hardware requirements.
	YDIS.exe is not installed in application directory.	If YDIS.exe is not found in the application directory, install the application again.
	Other application (Service tool) is already in operation.	Quit the application in operation, since two applications (Service tool) cannot be operated simultaneously.
Application related error occurs	Error message "Program file or Database file is not installed properly. Please install again." is displayed.	Install program file or database file again.
Database related error occurs	Error message "Database files are not installed properly. Please update again." is displayed.	Update database again.
	Error message "System file not found #####.###." is displayed.	The database is not applicable to communication with ECM. Update database to correspond to ECM.
Incorrect fonts on screen	The computer language does not correspond to the application.	Use a computer that operates the required operating system.
When executing the stationary test or active test, the test cannot be ended even if the Cancel is clicked.	Execute and Cancel buttons have been clicked more than necessary, and the ECM or PC does not operate properly.	Turn off your PC. Push the engine stop switch and reset the ECM.

## APPENDIX

### SETTING THE DESKTOP AREA

Use the following procedure to set the Yamaha Diagnostic System desktop area.

Compatible with VGA (640 × 480 pixels) or SVGA (800 × 600 pixels) or more recommended.

1. From the taskbar at the bottom of your computer screen, click the **Start** button, point to **Settings**, and then open the **Control Panel**.
2. In the Control Panel, double-click **Display** (Fig. 73).

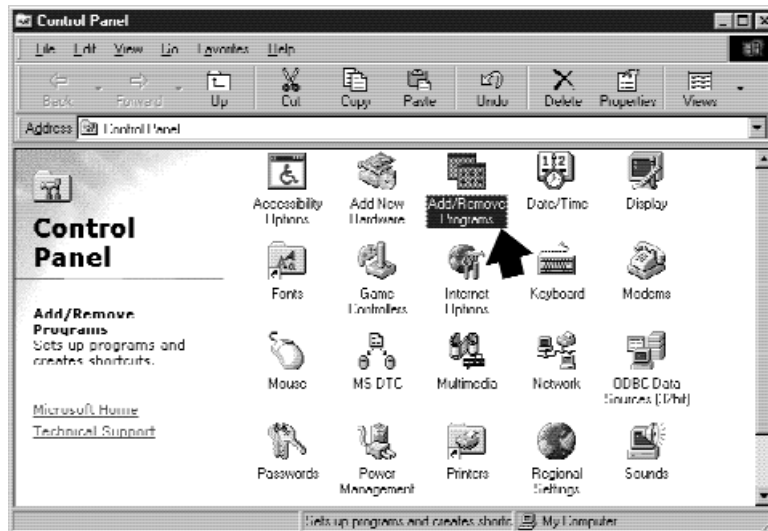


Fig. 73

3. Select **Settings** and slide the Desktop area slider (Fig. 74).

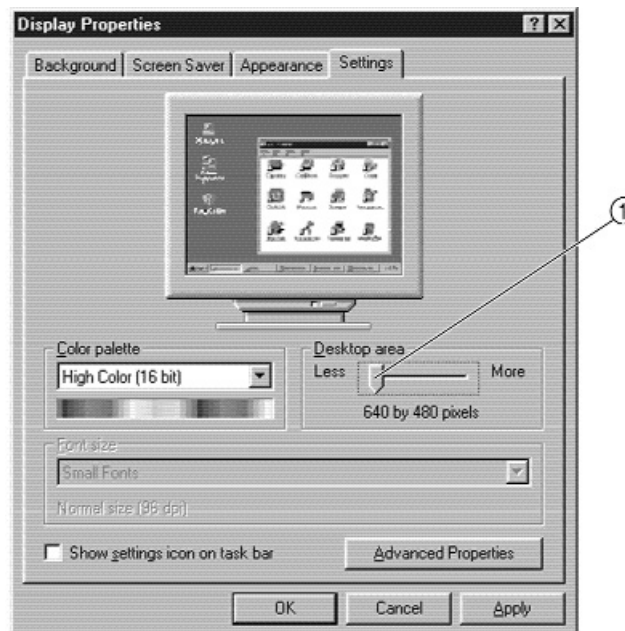


Fig. 74

① Slider

4. Click the **OK** button in the confirmation window to set the display area. To cancel, click the **Cancel** button (see Figs. 75~76).

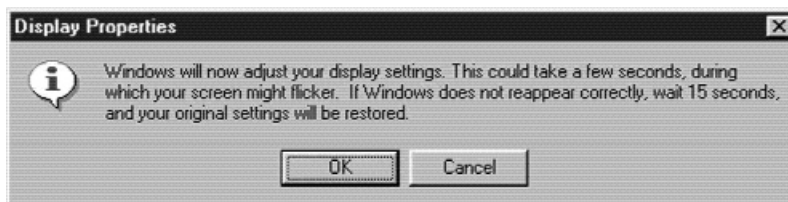


Fig. 75

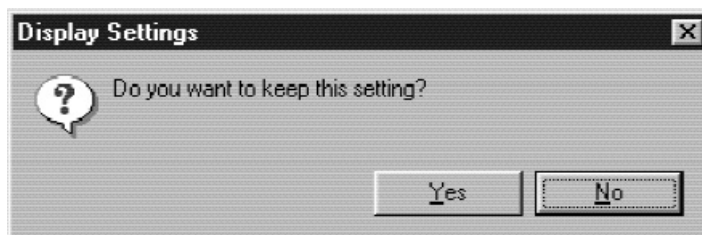


Fig. 76

## TROUBLE ANALYSIS

**NOTE:**

The following items should be checked before the "TROUBLE ANALYSIS CHART" is **consulted**:

1. The battery is charged and its specified gravity is within specification.
2. There are no incorrect wiring connections.
3. Wiring connections are properly secured and are not rusty.
4. The engine shut-off cord (lanyard) is installed onto the engine shut-off switch.
5. Fuel is reaching the throttle body.

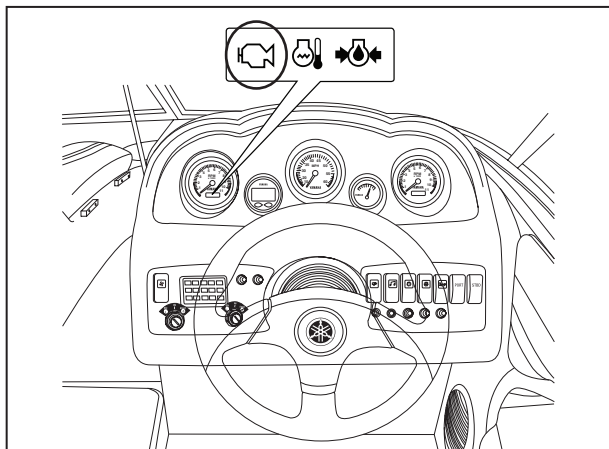
## TROUBLE ANALYSIS CHART

Trouble mode														Check elements		
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOW OIL PRESSURE	LOOSE STEERING	BILGE INCREASE	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	FUEL SYSTEM	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fuel tank	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fuel tank breather hose	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fuel hose	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fuel filter	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fuel pump	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fuel injectors	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Trolling speed	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Air filter	3

Trouble mode															Check elements		
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOW OIL PRESSURE	LOOSE STEERING	BILGE INCREASE	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter	
															POWER UNIT		
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Compression	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cylinder head gaskets	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cylinder block	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Crankcase	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Piston rings	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pistons	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Bearings	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Thermostat	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Valve(s) and valve seat(s)	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Valve clearance adjusting pad(s)	3	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Camshaft(s)	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Timing chain	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Oil pump	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Engine oil	3	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Oil filter	3	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Oil pressure switch	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Bearing housing	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Drive couplings	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rubber coupling	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pilot water hose	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Water hose	5	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Water passage	5	

Trouble mode														Check elements		
ENGINE WILL NOT START	HARD STARTING	ROUGH IDLING	HIGH IDLING	ENGINE STALLS	POOR ACCELERATION	ENGINE WILL NOT STOP	POOR PERFORMANCE	LIMITED ENGINE SPEED	OVERHEATING	LOW OIL PRESSURE	LOOSE STEERING	BILGE INCREASE	IRREGULAR WARNING INDICATION	POOR BATTERY CHARGING	Relative part	Reference chapter
														JET PUMP UNIT		
							○		○			○			Duct	6
							○								Impeller	6
							○		○						Intake grate	6
		○					○		○						Bearings	6
							○		○						Intake duct	6
									○						Water inlet hose	6
												○			Bilge hose	6
												○			Bilge strainer	3
												○			Bilge hose joint	6
														ELECTRICAL		
														Ignition system, fuel control system		
○	○	○		○	○		○								• Pulser coils	7
○			○	○		○	○	○							• ECM	7
○	○	○		○	○		○								• Ignition coils	7
○				○		○									• Slant detector switch	7
○						○									• Engine stop switch	7
○						○									• Engine shut-off switch	7
○	○	○	○	○	○	○	○								• Spark plugs	3
○						○									• Main and fuel pump relay	7
													○		• Thermoswitch	7
	○	○	○												• Intake air pressure sensor	7
	○	○	○												• Intake air temperature sensor	7
	○	○	○										○		• Engine temperature sensor	7
		○	○		○		○								• Throttle position sensor	7
○	○	○		○	○		○	○							• Cam position sensor	7





### YDIS Error Code Chart

When a flashing Check Engine signal is displayed you should connect the Yamaha Diagnostic System to the affected engine in order to identify the cause. YDIS is capable of detecting the cause and indicating one or multiple codes for a variety of problems. Codes and other running data can be saved and downloaded for further troubleshooting.

Code	Symptom
01	No malfunction
13	Incorrect pickup coil signal
15	Incorrect engine temp sensor signal
18	Incorrect throttle position sensor signal
19	Incorrect battery voltage
23	Incorrect intake air temperature sensor signal
24	Incorrect cam position sensor signal
29	Incorrect intake air pressure sensor signal
48	Incorrect data transmission
54	Incorrect bypass valve motor signal
63	Incorrect intake air system signal

**NOTE:** At the time of this publication it is recommended that YDIS versions 1.23 or later be used with the boats covered in this manual.

Please check for newer versions of the YDIS software.

**NOTE:** For complete Instructions on use of the Yamaha Diagnostic System, see the SR230 Service Manual LIT-18616-02-52, Chapter 9.



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